Changes for the Better

MITSUBISHI ELECTRIC

CNC

MELDAS C6/C64

CONNECTION AND MAINTENANCE MANUAL

BNP-B2255E(ENG)

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Introduction

This manual is called MELDAS C6/C64 CONNECTION AND MAINTENANCE MANUAL and covers the items related to installation, connection and maintenance of this NC unit. Read this manual thoroughly before using. For safe use, fully understand "Precautions for Safety" on the next page first.

Details described in this manual:

⚠ CAUTION

- ⚠ For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder takes precedence over this manual.
- ⚠ Items that are not described in this manual must be interpreted as "not possible".
- ⚠ This manual is written on the assumption that all option functions are added. Confirm the specifications issued by the machine tool builder before use.
- ⚠ Refer to the Instruction Manual issued by each machine tool builder for details on each machine tool.
- ⚠ Some screens and functions may differ depending on each NC system (or version), and some functions may not be possible. Please confirm the specifications before use.

The following manuals can be used for reference:

MELDAS C6/C64/C64T Instruction Manual	BNP-B2259
MELDAS C6/C64/C64T PLC Interface Manual	BNP-B2261
MELDAS C6/C64/C64T Parameter Manual	BNP-B2267

Precautions for Safety

Always read this manual and enclosed documents before installation, operation, maintenance and inspection to ensure correct usage. Thoroughly understand the basics, safety information and precautions of the devices before using.
This manual classifies the safety precautions into "**DANGER**", "**WARNING**" and "**CAUTION**".

⚠ **DANGER**	When the user could be subject to imminent fatalities or serious injuries if handling is mistaken.
⚠ **WARNING**	When the user could be subject to fatalities or serious injuries if handling is mistaken.
⚠ **CAUTION**	When the user could be subject to minor or moderate injuries or the property could be damaged if handling is mistaken.

Note that the items under "⚠ **CAUTION**", could lead to serious consequences as well depending on the situation. Please follow all items listed in “Precautions for Safety” as they are equally important.

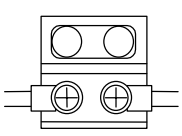
For Safe Use

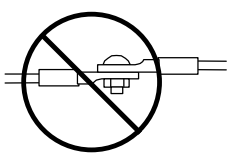
This product is not designed or manufactured on the assumption that the product will be used for the equipment or systems that are to be subject to any fatal consequences. Please inquire our customer service department about any particular usage other than the normal usage as a machine tool.

1. Items related to prevention of electric shocks.

⚠ WARNING

- Do not open/close the front cover while the power is ON or during operation. The high voltage terminals and charged sections will be exposed, and this could result in electric shocks.
- Do not remove the front cover even when the power is OFF, except for the wiring works or periodic inspections. The inside of the controller and servo drive unit are charged, and this could result in electric shocks.
- Always wait at least 15 minutes after turning the power OFF. Then, check the voltage with a tester, etc., before wiring works, inspections or connecting with peripheral devices. Failure to observe this could result in electric shocks.
- Earth ground the controller, servo drive unit and servomotor according to the local laws. (In Japan, ground the 200V Series input products with Class C or higher protective grounding and the 400V Series input with Class D or higher protective grounding.)
- All wiring works, maintenance and inspections must be carried out by a qualified technician. Failure to observe this could result in electric shocks. Contact your nearby Service Center or Service Station for replacing parts and servicing.
- Wire the controller, servo drive unit and servomotor after installation. Failure to observe this could result in electric shocks.
- Do not operate the switches with wet hands. Failure to observe this could result in electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables. Failure to observe this could result in electric shocks.
- Insulate the power lead using a fixed terminal block. Failure to observe this could result in electric shocks.





2. Items related to prevention of fire

⚠ CAUTION

- Install the controller, servo drive unit, servomotor and regenerative resistor on non-combustible material. Installation directly on or near combustible materials could result in fires.
- If any malfunction in the unit is observed, shut off the power at the unit's input power side. Continuous flow of large current could result in fires.
- Install an appropriate NFB (circuit breaker) and MC (contactor) on the power input section of the servo drive unit and configure the sequence that shuts the power off upon drive unit's emergency stop or alarm.
- When a breaker is shared for multiple power supply units, the breaker may not function upon short-circuit failure in a small capacity unit. Do not share a breaker for multiple units as this is dangerous.
- Incorrect wiring and connections could cause the devices to damage or burn.

3. Items related to prevention of bodily injury or property damage

⚠ DANGER

- When transporting or installing a built-in IPM spindle or linear servomotor, be careful so that your hand or property will not be trapped in the servomotors or other metal objects. Also keep the devices with low magnetic tolerance away from the product.

⚠ CAUTION

- Do not apply voltages to other than those indicated in the connection manual for the controller or specifications manual for the servo drive unit. Failure to observe this could cause the devices to rupture or damage, etc.
- Incorrect terminal connections could cause the devices to rupture or damage, etc.
- Incorrect polarity (+ -) could cause the devices to rupture or damage, etc.
- Persons wearing medical devices, such as pacemakers, must stay away from this unit. The electromagnetic waves could adversely affect the medical devices.
- Fins on the rear of the unit, regenerative resistor and servomotor, etc., will be hot during operation and for a while after the power has been turned OFF. Do not touch or place the parts and cables, etc. close to these sections. Failure to observe this could result in burns.
- Do not enter the machine's movable range during automatic operation. Keep your hands, feet or face away from the spindle during rotation.

4. General Precautions

Always follow the precautions below. Incorrect handling could result in faults, injuries or electric shocks, etc.

(1) Transportation and installation

⚠ CAUTION

- ⚠ Correctly transport the products according to the weights.
- ⊘ Use servomotor's suspension bolts to transport the servomotor itself. Do not use it to transport the servomotor after installation onto the machine.
- ⚠ Do not stack the products exceeding the indicated limit.
- ⚠ Do not hold the cables, shaft or detector when transporting the servomotor.
- ⚠ Do not transport the controller or servo drive unit by suspending or holding the connected wires or cables.
- ⚠ Do not hold the front cover when transporting the servo drive unit, or the front cover could come off, causing the unit to drop.
- ⚠ Install on a non-combustible place where the unit's or motor's weight can be withstood according to the instruction manual.
- ⚠ The servomotor does not have a complete water-proof (oil-proof) structure. Do not allow oil or water to contact or enter the motor. Prevent the oil-soaked cutting chips from being accumulated on the motor.
- ⚠ When installing the motor facing upwards, take measures on the machine side so that gear oil, etc., will not enter the motor shaft.
- ⚠ Do not remove the detector from the servomotor. (The detector installation screw is treated with sealing.)
- ⚠ Do not allow foreign matters, especially, conductive foreign matters such as screws or metal chips, or combustible foreign matters such as oil, to enter the controller, servo drive unit or servomotor. Failure to observe this could result in rupture or damage.
- ⚠ Do not get on the product or place heavy objects on it.
- ⚠ Provide appropriate distance between the controller/servo drive unit and inner surface of the control panel/other devices.
- ⚠ Do not install or operate the controller, servo drive unit or servomotor that is damaged or has missing parts.

⚠ CAUTION

⚠ Take care not to cut hands, etc. with the heat radiating fins or metal edges.

⚠ Do not block the intake/outtake ports of the servomotor with the cooling fan.

⚠ Install the controller's display unit and operation board unit on the spot where cutting oil will not reach.

⚠ The controller, servo drive unit and servomotor are precision devices, so do not drop or apply thumping vibration and strong impacts on them.

⚠ Hard disk unit is a precision device, so do not drop or apply strong impacts on it.

⚠ Store and use the units according to the environment conditions indicated in each specifications manual.

⚠ Securely fix the motor to the machine. The motor could come off during operation if insecurely fixed.

⚠ Always install the servomotor with reduction gear in the designated direction. Failure to observe this could result in oil leaks.

⚠ Always install a cover, etc., over the shaft so that the rotary section of the spindle motor cannot be touched during motor rotation.

⚠ When using a coupling connection to the servomotor shaft end, do not apply impacts by hammering, etc. The detector could be damaged.

⚠ Use a flexible coupling when connecting with a ball screw, etc., and keep the shaft core deviation smaller than the tolerable radial load of the shaft.

⚠ Do not use a rigid coupling as an excessive bending load will be applied on the shaft and could cause the shaft to break.

⚠ Do not apply a load exceeding the tolerable level onto the motor shaft. The shaft or bearing could be damaged.

❗ Before using this product after a long period of storage, please contact the Mitsubishi Service Station or Service Center.

⚠ Following the UN recommendations, battery units and batteries should be transported based on the international regulations such as those determined by International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), International Maritime Organization (IMO) and U.S. Department of Transportation (DOT).

(2) Items related to wiring

⚠ CAUTION

⚠ Correctly wire this product. Failure to observe this could result in servomotor runaway, etc.

⚠ Do not install a phase advancing capacitor, surge absorber or radio noise filter on the output side of the servo drive unit.

⚠ Correctly connect the output side (terminal U, V, W). The servomotor will not run properly if incorrectly connected.

⚠ Always install an AC reactor per each power supply unit.

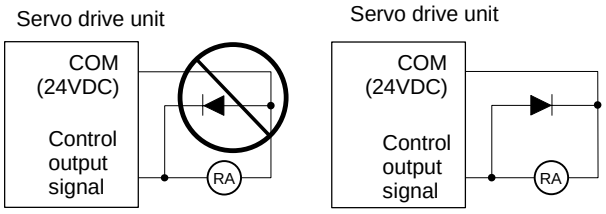
⚠ Always install an appropriate breaker per each power supply unit. A breaker cannot be shared for multiple power supply units.

⚠ Do not directly connect a commercial power supply to the servomotor. Failure to observe this could result in faults.

❗ When using an inductive load such as relays, always connect a diode in parallel to the load as a noise countermeasure.

❗ When using a capacitive load such as a lamp, always connect a protective resistor in series to the load to suppress rush currents.

⚠ Do not mistake the direction of the surge absorption diode to be installed on the DC relay for the control output signal. If mistaken, the signal will not be output due to fault in the drive unit, and consequently the protective circuit, such as emergency stop, could be disabled.



🚫 Do not connect or disconnect the connection cables between each unit while the power is ON.

⚠ Do not connect or disconnect the PCBs while the power is ON.

⚠ Do not pull the cables when connecting/disconnecting it.

⚠ Securely tighten the cable connector fixing screw or fixing mechanism. Insufficient fixing could result in dislocation during operation.

⏚ Always treat the shield cables indicated in the Connection Manual with grounding measures such as cable clamps.

⚠ CAUTION

⚠ Separate the signal wire from the drive line or power line when wiring.

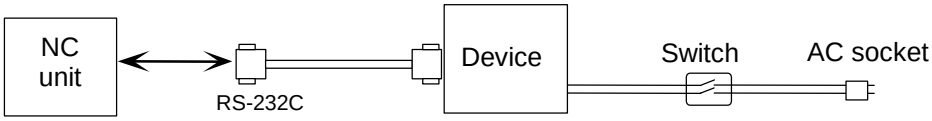
⚠ Use wires and cables whose wire diameter, heat resistance level and bending capacity are compatible with the system.

Ground the device according to the requirements of the country where the device is to be used.

⚠ Wire the heat radiating fins and wires so that they do not contact.

⚠ When using the RS-232C device as a peripheral device, caution must be paid for connector connection/disconnection.

Always use a double-OFF type AC power supply switch on the device side, and connect/disconnect the connector with the AC power supply on the device side OFF.



(3) Adjustments

⚠ CAUTION

⚠ Check and adjust programs and each parameter before starting operation. Unpredictable operations could occur depending on the machine.

⚠ Do not make drastic adjustments or changes as the operation could become unstable.

(4) Usage

⚠ CAUTION

Install an external emergency stop circuit so that the power will turn OFF followed by the immediate operation stop. A contactor, etc., is required in addition to the shutoff function mounted in the controller.

⚠ Turn OFF the power immediately if any smoke, abnormal noise or odor is generated from the controller, servo drive unit or servomotor.

Only a qualified technician may disassemble or repair this product.

⚠ CAUTION

⚠ Do not alter.

⚠ Use a noise filter, etc. to reduce the effect of electromagnetic disturbances. Electromagnetic disturbances could adversely affect the electronic devices used near the servo drive unit.

⚠ Use the servo drive unit, servomotor and each regenerative resistor with the designated combination. Failure to observe this could result in fires or faults.

⚠ The combination of the servomotor and servo drive unit that can be used is determined. Be sure to check the models of servomotor and servo drive unit before test operation.

⃠ The brakes (electromagnetic brakes) mounted in the servomotor are used for the purpose of holding, and must not be used for normal braking. Also, do not run the motor with the motor brake applied. Motor brake is used for the purpose of holding.

⚠ For the system running via a timing belt, install a brake on the machine side so that safety can be ensured.

⚠ Be sure to confirm SERVO OFF (or READY OFF) when applying the magnetic brake. Also, be sure to confirm SERVO ON prior to releasing the brake.

❗ When using the DC OFF type electromagnetic brake, be sure to install a surge absorber on the brake terminal.

⃠ Do not connect or disconnect the cannon plug while the electromagnetic brake's power is ON. The cannon plug pins could be damaged by sparks.

⚠ After changing programs/parameters, or after maintenance/inspection, always carry out a test operation before starting actual operation.

⚠ Use the power (input voltage, input frequency, tolerable instantaneous power failure time) that are complied with the power specification conditions indicated in each Specifications manual.

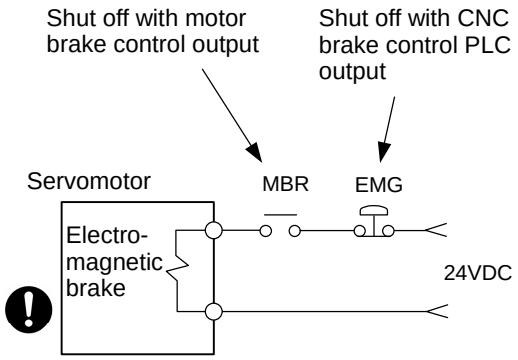
⚠ When making detector cables, do not mistake connection. Failure to observe this could result in malfunction, runaway or fire.

⚠ When using NC card, first power ON the NC card, and then the base I/O unit. If the base I/O unit is powered ON first, current flows from the connection cable to the NC card, resulting in malfunction in the PC or the cards installed in the PC.

(5) Troubleshooting

⚠ CAUTION

⚠ Use a servomotor with electromagnetic brakes or establish an external brake mechanism for the purpose of holding; this serves as countermeasures for possible hazardous situation caused by power failure or product fault.



⚠ Use a double circuit structure for the electromagnetic brake's operation circuit so that the brakes will activate even when the external emergency stop signal is issued.

⚠ The machine could suddenly restart when the power is restored after an instantaneous power failure, so stay away from the machine. (Design the machine so that the operator safety can be ensured even if the machine restarts.)

⚠ To secure the absolute position, do not shut off the servo drive unit's control power supply when its battery voltage becomes low (warning 9F)

❗ If the battery voltage drop warning alarm occurs, make sure to back up the machining programs, tool data and parameters, etc. with the input/output device before replacing the battery.
Depending on the level of voltage drop, there is the possibility of memory loss. Reload all the data backed up before the alarm occurrence.

(6) Maintenance, inspection and part replacement

⚠ CAUTION

⚠ Periodically back up the programs, tool data and parameters to avoid potential data loss. Also, back up those data before maintenance and inspections.

❗ When replacing the battery on the controller side, the machining programs, tool data and parameters, etc., should be backed up with the input/output device beforehand.
In case the memory is damaged in replacing the batteries, reload all the data backed up before the alarm occurrence.

⚠ The electrolytic capacitor's capacity will drop due to deterioration. To prevent secondary damage due to capacitor's faults, Mitsubishi recommends the electrolytic capacitor to be replaced approx. every five years even when used in a normal environment. Contact the Service Center or Service Station for replacements.

⚠ Do not perform a megger test (insulation resistance measurement) during inspection.

⚠ Do not replace parts or devices while the power is ON.

⚠ CAUTION
Do not short-circuit, charge, overheat, incinerate or disassemble the battery.
The hard disk unit has a service life, and must be replaced before its expiration.
As a precautionary measure, always back up the customer's data stored in the hard disk unit. The safety of the customer's data stored in the hard disk unit cannot be guaranteed.
There may be a unit filled with substitute Freon in the heat radiating fins of the 37kW or smaller unit. Be careful not to break the heat radiating fins during maintenance or replacement.

(7) Disposal

⚠ CAUTION
Take the batteries and backlights for LCD off from the controller, servo drive unit and servomotor, and dispose of them as general industrial wastes.
Do not alter or disassemble controller, servo drive unit, or servomotor.
Dispose of the spent batteries and the backlights for LCD according to the local laws.

(8) General precautions

To explain the details, drawings given in this instruction manual, etc., may show the unit with the cover or safety partition removed. When operating the product, always place the cover or partitions back to their original position, and operate as indicated in the instruction manual, etc.

CONTENTS

I. Connection Manual

II. Maintenance Manual

I. Connection Manual

1. OUTLINE

This manual explains the items required for installing and connecting the MELDAS C6/C64.
Read this manual thoroughly and understand the product's functions and performance before starting to use.
This manual is written on the assumption that all option functions are added, but the actually delivered device may not have all functions.

Refer to the following documents for explanations on the functions.

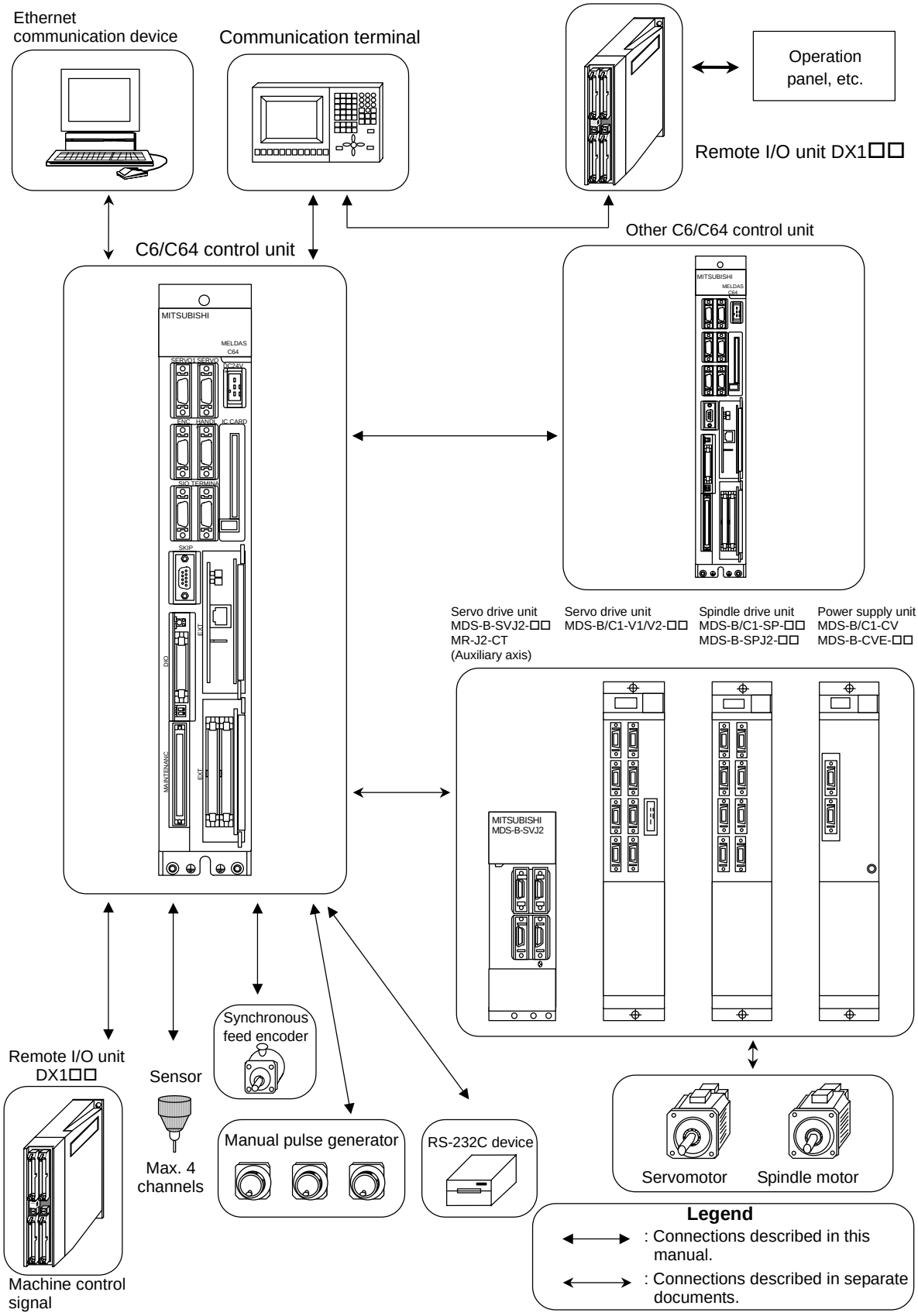
MELDAS C6/C64 Specifications Manual BNP-B2266
MELDAS C6/C64/C64T PLC Interface Manual BNP-B2261
MELDAS AC Servo and Spindle MDS-C1 Series Specifications Manual BNP-C3000
MELDAS MDS-B-SVJ2 Series Specifications Manual BNP-B3937

Refer to the following document for details on the EMC Instructions for the European CE Marking.

EMC Installation Guidelines BNP-B2230

2. CONFIGURATION

2.1 System Configuration



2.2 List of Configuration Units

1. Control unit

Type		Configuration element	Details
FCU6-MU043 FCU6-MU042 FCU6-MU041	C6 Control unit C64 Control unit C64T Control unit	HR851 card	Main card
		HR891 card	Back panel
		HR899 card	IC card interface

2. Extension unit

Type		Configuration element	Details
FCU6-EX871	DeviceNet (Master)	HR871 card	Expansion card
FCU6-EX872	DeviceNet (Slave)	HR872 card	Expansion card
FCU6-EX873	FL-net	HR873 card	Expansion card
FCU6-EX875	Ethernet	HR875/876 card	Expansion card, Use as set
FCU6-EX878	MELSECNET10 (Coaxial interface)	HR877/878 card	Expansion card, Use as set
FCU6-EX879	MELSECNET10 (Optical interface)	HR877/879 card	Expansion card, Use as set
FCU6-EX878	MELSECNET/10 (Coaxial)	HR877/878 card	Use as set
FCU6-EX879	MELSECNET/10 (Optical)	HR877/879 card	Use as set
FCU6-HR865	CC-Link	HR865 card	Expansion card
FCU6-EX871-40	DeviceNet	HR871 card	Expansion card
FCU6-HR881	Extension DIO (Sink type)	HR881 card	Expansion card
FCU6-HR882	Extension DIO (Sink type, with AO)	HR882 card	Expansion card
FCU6-HR883	Extension DIO (Source type)	HR883 card	Expansion card
FCU6-HR884	Extension DIO (Source type, with AO)	HR884 card	Expansion card
FCU6-HR893	External extension unit	HR893 card	Extension back panel, a set of metal plates

3. Communication terminal (display/NC keyboard)

Type		Configuration element	Details
FCUA-LD100	7.2-type monochrome LCD with integrated keyboard (Integrated type/machining system sheet)	7.2- type mono-chrome LCD RX213 card Key switch / escutcheon	Control card 24VDC input
FCUA-LD10	7.2- type monochrome LCD with display unit (Keyboard separated type)	7.2- type mono-chrome LCD Escutcheon RX213 card	Use as set with FCUA-KB20 Control card 24VDC input
FCU6-DUT32	10.4- type monochrome LCD with display unit (Keyboard separated type)	10.4- type mono-chrome LCD Escutcheon RX215 card	Use as set with FCUA-KB20 Control card 24VDC input
FCUA-CT100	Keyboard integrated type with 9- type CRT (Integrated type/machining system sheet)	9- type CRT RX211 card Key switch / escutcheon	Control card 24VDC input CRT 100VAC input
FCUA-CT120	Keyboard integrated type with 9- type CRT (Integrated type/lathe system sheet)	9- type CRT RX211 card Key switch / escutcheon	Control card 24VDC input CRT 100VAC input
FCUA-CR10	Display unit with 9- type CRT (Keyboard separated type)	9- type CRT Escutcheon	Use as set with FCUA-KB10 Control card 24VDC input CRT 100VAC input
FCUA-KB10	Keyboard (Separated type/machining system sheet)	Key switch RX211 card	Use as set with FCUA-CR10
FCUA-KB20	Keyboard (Separated type/machining system sheet)	Key switch	Use as set with FCUA-LD10 or FCU6-DUT32
FCU6-KB021	Keyboard (Separated type/machining system sheet)	Key switch	Use as set with FCU6-DUT32 (FCUA-KB20 with changed outline dimensions)
FCUA-KB30	Keyboard (Separated type/lathe system sheet)	Key switch	Use as set with FCUA-LD10 or FCU6-DUT32
FCU6-KB031	Keyboard (Separated type/lathe system sheet)	Key switch	Use as set with FCU6-DUT32 (FCUA-KB30 with changed outline dimensions)

4. Peripheral device

Type		Configuration element	Details
HD60	Manual pulse generator		With MELDAS logo
HD61-1	Manual pulse generator		Without MELDAS logo
Ground plate D			Grounding plate D, one set
Ground plate E			Grounding plate E, one set

5. Remote I/O unit

Type		Configuration element	Details
FCUA-DX100	DI (sink/source)/DO (sink) = 32/32	RX311	Base PCB : DI (sink/source)/ DO (sink) = 32/32
		Case	
FCUA-DX110	DI (sink/source)/DO (sink) = 64/48	RX311	Base PCB : DI (sink/source)/ DO (sink) = 32/32
		RX321-1	Add-on PCB: DI (sink/source)/ DO (sink) = 32/16
		Case	
FCUA-DX120	DI (sink/source)/DO (sink) = 64/48 Analog output 1 point	RX311	Base PCB : DI (sink/source)/ DO (sink) = 32/32
		RX321	Add-on PCB: DI (sink/source)/ DO (sink) = 32/16 analog output 1 point
		Case	
FCUA-DX130	DI (sink/source)/DO (sink) = 32/32 Manual pulse 2ch	RX311	Base PCB : DI (sink/source)/ DO (sink) = 32/32
		RX331	Add-on PCB: Manual pulse generator 2ch
		Case	
FCUA-DX140	DI (sink/source)/DO (sink) = 32/32 Analog input 4 points, analog output 1 point	RX311	Base PCB : DI (sink/source)/ DO (sink) = 32/32
		RX341	Add-on PCB: Analog input 4 points, analog output 1 point
		Case	
FCUA-DX101	DI (sink/source)/ DO (source) = 32/32	RX312	Base PCB : DI (sink/source)/ DO (source) = 32/32
		Case	
FCUA-DX111	DI (sink/source)/ DO (source) = 64/48	RX312	Base PCB : DI (sink/source)/ DO (source) = 32/32
		RX322-1	Add-on PCB: DI (sink/source)/ DO (source) = 32/16
		Case	
FCUA-DX121	DI (sink/source)/ DO (source) = 64/48 Analog output 1 point	RX312	Base PCB : DI (sink/source)/ DO (source) = 32/32
		RX322	Add-on PCB: DI (sink/source)/ DO (source) = 32/16 analog output 1 point
		Case	
FCUA-DX131	DI (sink/source)/ DO (source) = 32/32 Manual pulse 2ch	RX312	Base PCB : DI (sink/source)/ DO (source) = 32/32
		RX331	Add-on PCB: Manual pulse generator 2ch
		Case	
FCUA-DX141	DI (sink/source)/ DO (source) = 32/32 Analog input 4 points, analog output 1 point	RX312	Base PCB : DI (sink/source)/ DO (source) = 32/32
		RX341	Add-on PCB: Analog input 4 points, analog output 1 point
		Case	

3. INSTALLATION

3.1 General Specification

Type name			FCU6-MU043/MU042/MU041
Unit name			Control unit
General specifications	Ambient temperature	During operation	0 to 55°C
		During storage	–20 to 60°C
	Ambient humidity	During operation	Long term, Up to 75% RH (with no dew condensation) Short term (Within 1 month), Up to 95% RH (with no dew condensation)
		During storage	Up to 75% RH (with no dew condensation)
	Vibration resistance		4.9m/s^2 or less (during operation)
	Shock resistance		29.4m/s^2 or less (during operation)
	Working atmosphere		No corrosive gases, dust or oil mist
	Power noise		1kV (P-P)
Power specifications	Power voltage		24VDC±5% Ripple ±5% (P-P)
	Instantaneous stop tolerance time		2.1ms (during 24VDC line cutting)
	Current consumption		3A (max.)
Heating value			70W (during full option)
Weight			1.6kg
Unit size			Refer to Appendix.

Type name			MDS-B-SPJ2-□□□	MDS-B-SVJ2-□□□
Unit name			Spindle drive unit	Servo drive unit
General specifications	Ambient temperature	During operation	0 to 55°C	
		During storage	–20 to 65°C	
	Ambient humidity	During operation	Up to 90% RH (with no dew condensation)	
		During storage	Up to 90% RH (with no dew condensation)	
	Vibration resistance		5.9m/s^2 or less (during operation)	
	Working atmosphere		No corrosive gases, dust or oil mist	
	Power noise		1kV (P-P)	
Power specifications	Power voltage		3-phase 200VAC/230VAC –15% +10% 50/60Hz ±5%	
	Instantaneous stop tolerance time		20ms	
	Power consumption		Differs according to motor in use **(Note 1)**	Differs according to motor in use **(Note 2)**
Heating value				

Type name			MDS-B/C1-SP-□□□	MDS-B/C1-V1/V2-□□□	MDS-A-CR/MDS-C1-CV
Unit name			Spindle drive unit	Servo drive unit	Power supply unit
General specifications	Ambient temperature	During operation	0 to 55°C		
		During storage	–15 to 70°C		
	Ambient humidity	During operation	Up to 90% RH (with no dew condensation)		
		During storage	Up to 90% RH (with no dew condensation)		
	Vibration resistance		4.9m/s^2 or less (during operation)		
	Working atmosphere		No corrosive gases, dust or oil mist		
	Power noise		1kV (P-P)		
Power specifications	Power voltage		3-phase 200VAC/230VAC –15% +10% 50/60Hz ±5%		
	Instantaneous stop tolerance time		20ms		
	Power consumption		Differs according to motor in use **(Note 3)**		
Heating value					

(Note 1) Refer to the MDS-B-SPJ2 Specifications Manual.
(Note 2) Refer to the MDS-B-SVJ2 Specifications Manual.
(Note 3) Refer to the MDS-B Series Specifications Manual and MDS-C1 Series Specifications Manual.

Type name			FCUA-LD100/ FCUA-LD10+KB20	FCU6-DUT32 +KB021	FCUA-CT100/ FCUA-CR10+KB10
Unit name			Communication terminal		
General specifications	Ambient temperature	During operation	0 to 50°C		0 to 55°C
		During storage	–20 to 60°C		–20 to 65°C
	Ambient humidity	During operation	Long term, Up to 75% RH (with no dew condensation) Short term (Within 1 month), Up to 95% RH (with no dew condensation)		
		During storage	Up to 75% RH (with no dew condensation)		
	Vibration resistance		4.9m/s^2 or less (during operation)		
	Shock resistance		29.4m/s^2 or less (during operation)		
	Working atmosphere		No corrosive gases, dust or oil mist		
	Power noise		1kV (P-P)		
Power specifications	Power voltage		24VDC±5% Ripple ±5% (P-P)		Single phase 100 to 115VAC –15%+10% 50/60Hz±5%
					24VDC±5% Ripple ±5% (P-P)
	Instantaneous stop tolerance time		Follows specifications of 24VDC power supply being used		
	Current consumption		24V, 0.9A		100V, 0.4A 24V, 0.6A
Heating value			20W		55W
Weight			1600g	2200g	4800g
Unit size			Refer to Appendix.		

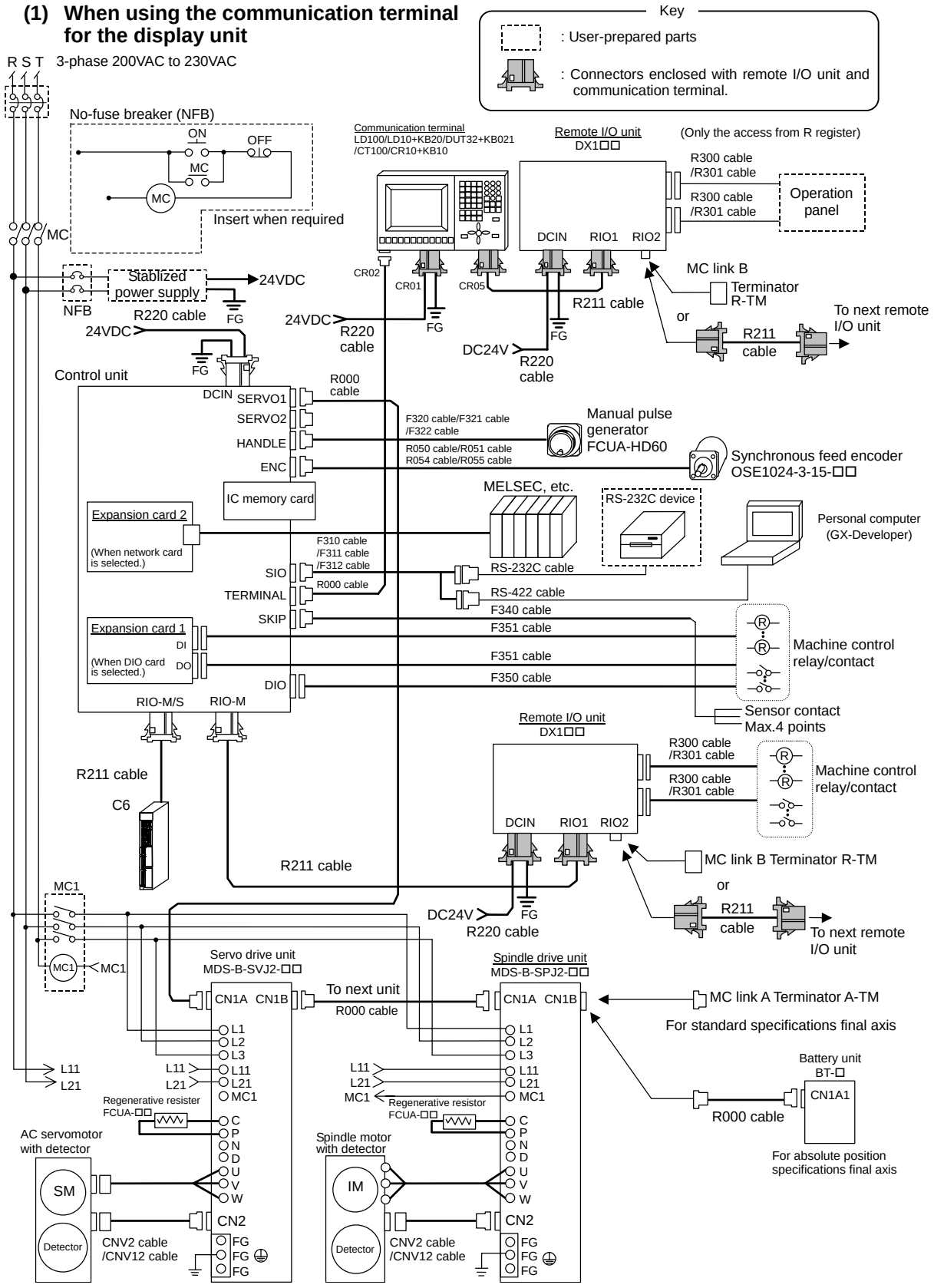
Type name			FCUA-DX10☐	FCUA-DX11☐	FCUA-DX12☐	FCUA-DX13☐	FCUA-DX14☐
Unit name			Remote I/O unit				
General specifications	Ambient temperature	During operation	0 to 55°C				
		During storage	–20 to 65°C				
	Ambient humidity	During operation	Long term, Up to 75% RH (with no dew condensation) Short term (Within 1 month), Up to 95% RH (with no dew condensation)				
		During storage	Up to 75% RH (with no dew condensation)				
	Vibration resistance		4.9m/s^2 or less (during operation)				
	Shock resistance		29.4m/s^2 or less (during operation)				
	Working atmosphere		No corrosive gases, dust or oil mist				
	Power noise		1kV (P-P)				
Power specifications	Power voltage		24VDC±5% Ripple ±5% (P-P)				
	Instantaneous stop tolerance time		–				
	Current consumption		24V, 0.7A **(Note 4)**	24V, 1.5A **(Note 4)**		24V, 0.7A **(Note 4)**	
Heating value			60W **(Note 5)**	110W **(Note 5)**		60W **(Note 5)**	
Weight			470g	570g	590g	550g	
Unit size			Refer to Appendix.				

(Note 4) Only the amount consumed by the control circuit.

(Note 5) When all points of the machine input/output interface circuit are operating.

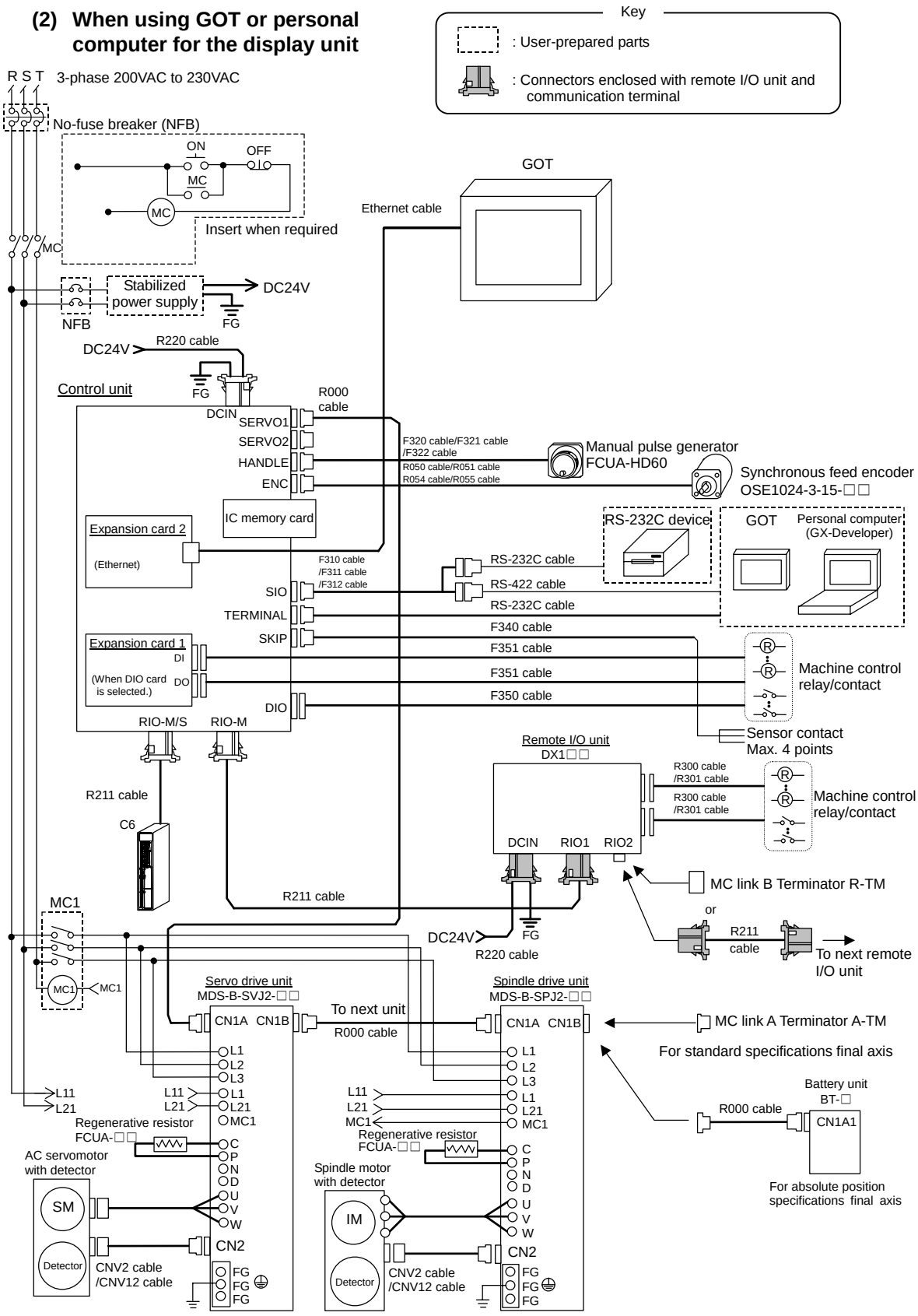
3.2 General Connection Diagram

(1) When using the communication terminal for the display unit



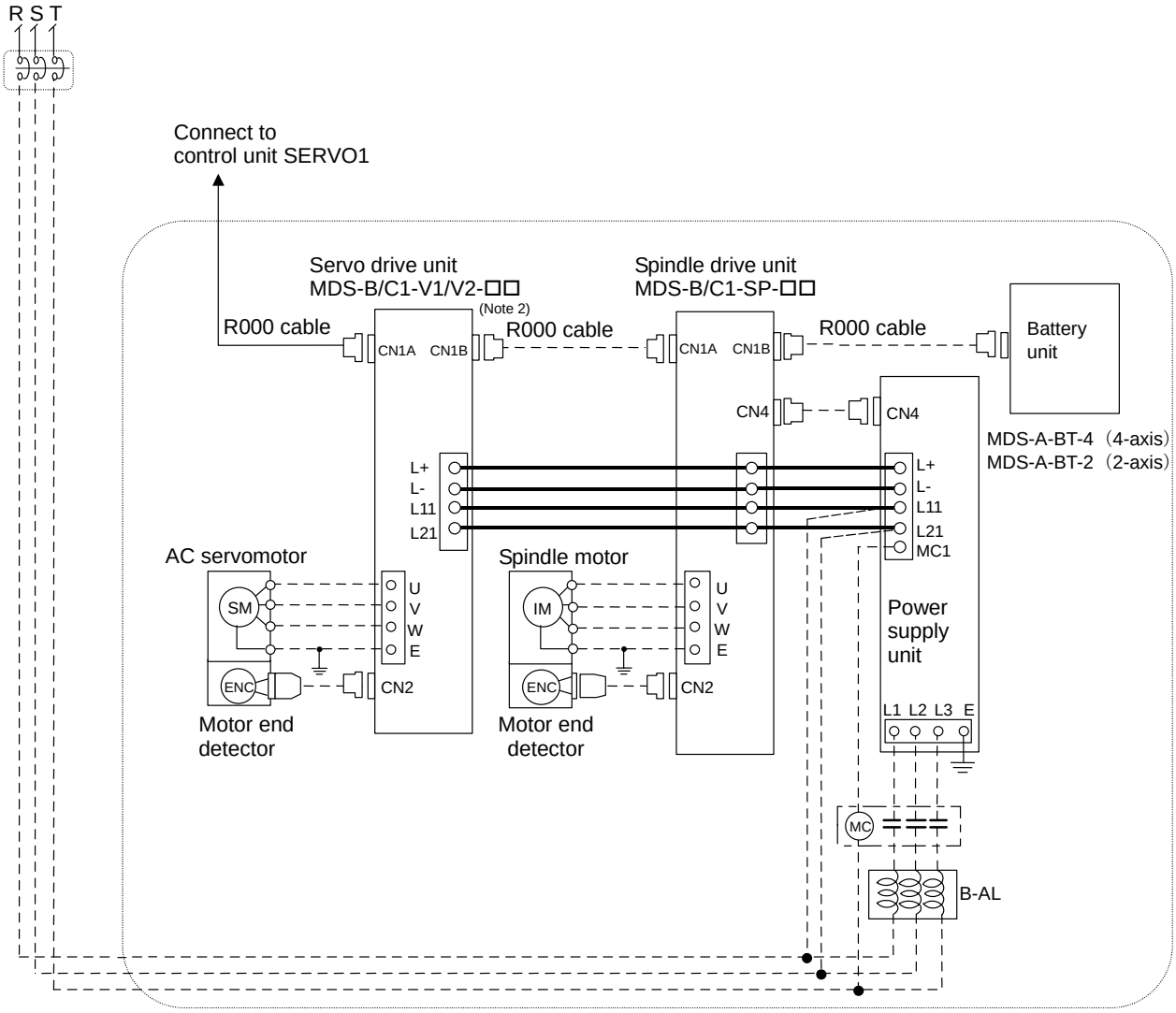
(Note) This diagram shows a general connection example. The actual connection may differ depending on the specifications.

(2) When using GOT or personal computer for the display unit



(Note) When using GOT or personal computer for the display unit, an Ethernet card (FCU6-EX875) must be mounted in the control unit's extension slot (EXT2).

(3) Example of Connection when Using V1/V2/SP for Drive Section



(Note 1) The drive section connection will differ according to the configuration of the servo amplifier and motor being used.
(Note 2) The R000 cable has the same specifications (connector types and connections) as the SH21 cable.
(Note 3) When connecting the spindle amplifier, set the axis No. to the value after the last servo axis.
(Note 4) The axis connected to the power supply unit is the last axis, or the axis connected to the battery unit.

⚠ CAUTION
⚠ Separate the signal wire from the drive line/power line when wiring.

3.3 Countermeasures against Heat Radiation

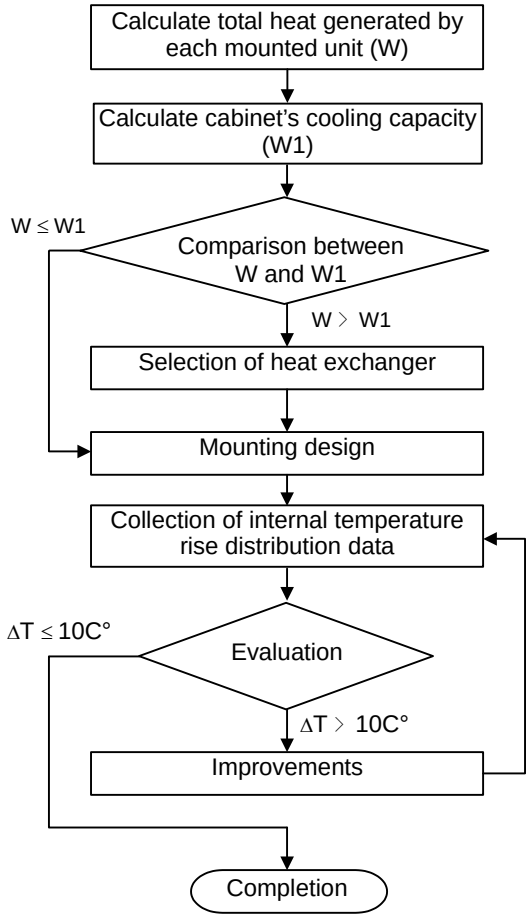
Please refer to the following procedures for heat radiation countermeasures.

Example of heat radiation countermeasures

<Hypothetical conditions>

(1) Average temperature in cabinet : T ≤ 55C°
(2) Cabinet peripheral temperature : Ta ≤ 0C° to 45C°
(3) Internal temperature rise value : ΔT = T - Ta(max) = 10 C°

Procedures for heat design and verification



<Supplement>

(1) Refer to section "3.1 General Specification" for the heat generated by each unit.
(2) Enclosed cabinet (thin steel plate) cooling capacity (W1) calculation equation

W1 = U x A x ΔT

U: $6W/m^2 \times C°$ ---with internal circulation fan
$4W/m^2 \times C°$ ---without internal circulation fan
A: Effective heat radiation area (m^2)
ΔT: Internal temperature rise value (10C°)
(Area where heat can be radiated from cabinet)

<Caution>

When calculating the effective heat radiation area, do not include the parts that contact other objects.

(3) Points of caution for heat radiation countermeasures when designing mounting state
* Consider convection in cabinet (eliminate heat spots)
* Collect hot air at suction port in heat exchanger cabinet.

(4) Criterion for internal temperature rise distribution data
ΔT (average value) ≤ 10C°
ΔTmax (maximum value) ≤ 15C°
R (inconsistency ΔTmax – ΔTmin) ≤ 6C°
(Evaluate existence of heat spots)

Refer to section "3.1 General Specification" for the heat generated by each unit.
If heat accumulates at the top of the control unit, install a circulation fan in the operation box.

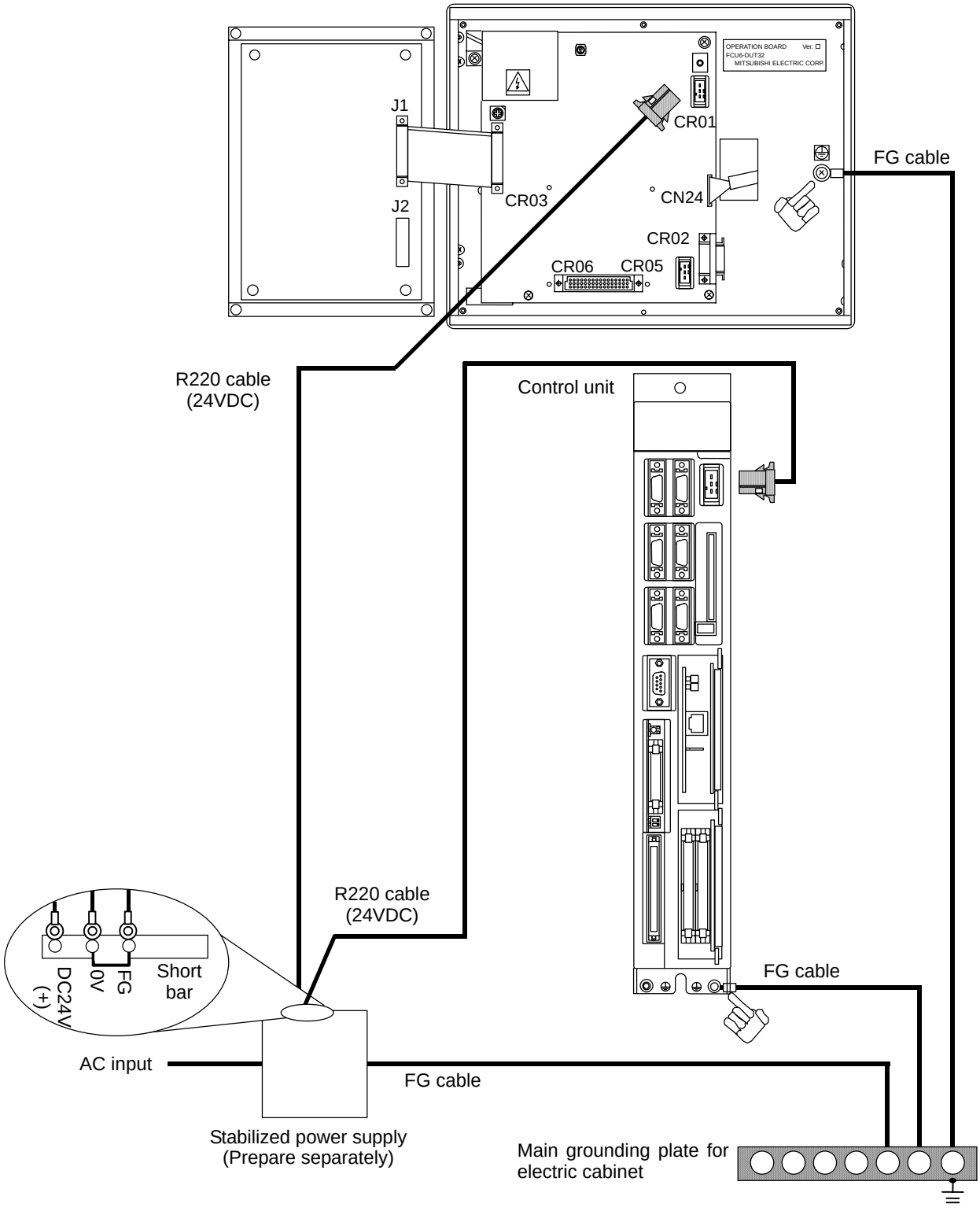
If the following conditions are not satisfied, install a circulation fan in the cabinet.
Criterion for internal temperature rise distribution data
ΔT (average value) ≤ 10°C
ΔT*max* (maximum value) ≤ 15°C

3.4 Noise Countermeasures

3.4.1 Connection of Frame Ground (FG)

The frame should basically be grounded at one ground point.
Connect the control unit and base I/O unit's 0V (RG) to the FG on the 24VDC stabilized power supply side.

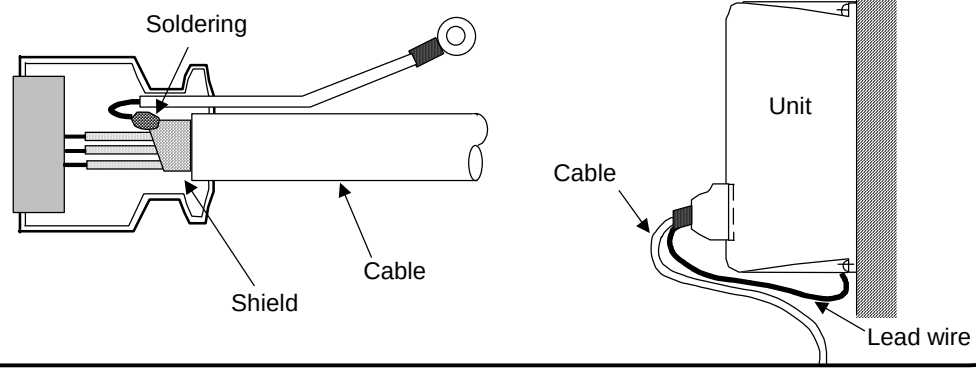
Communication terminal



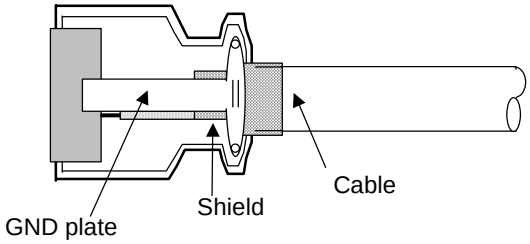
3.4.2 Shield Clamping of Cables

The shield cable connected to the control unit, servo amplifier and spindle amplifier must be connected to the grounding plate to stabilize operation while preventing malfunctioning due to noise.
The shield can be connected to the grounding plate with lead wires, clamp fittings or the connector GND plate. Refer to the following drawings to treat the shield cable.

Example of connection with lead wire

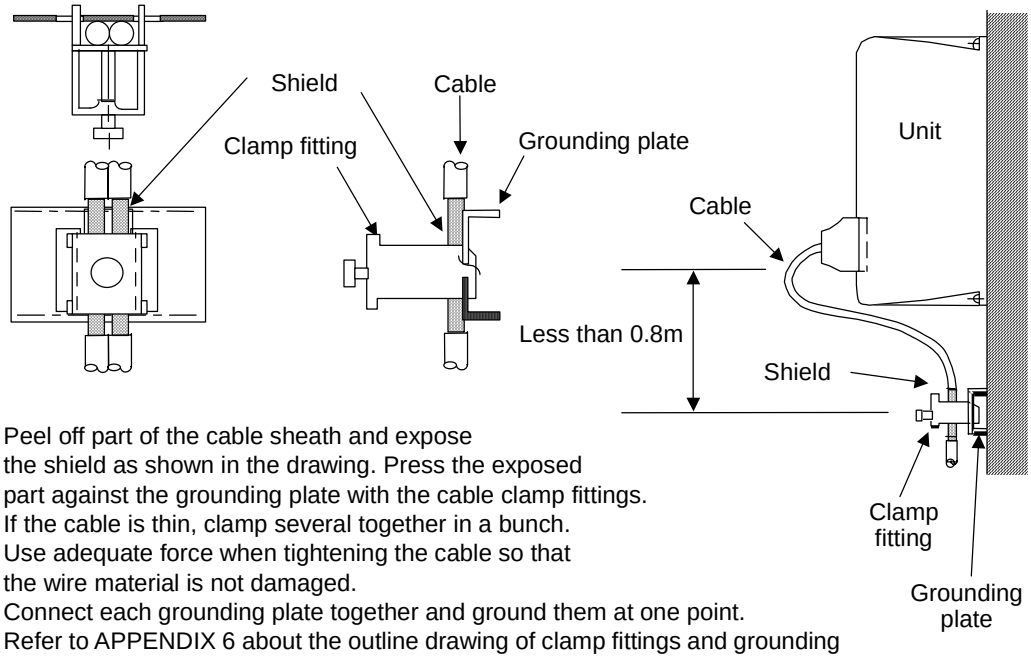


Example of connection with connector GND plate



Fold the cable shield over the sheath, and wrap copper foil tape around it. Connect the wound copper foil tape to the connector's GND plate.

Example of connection with clamp fitting



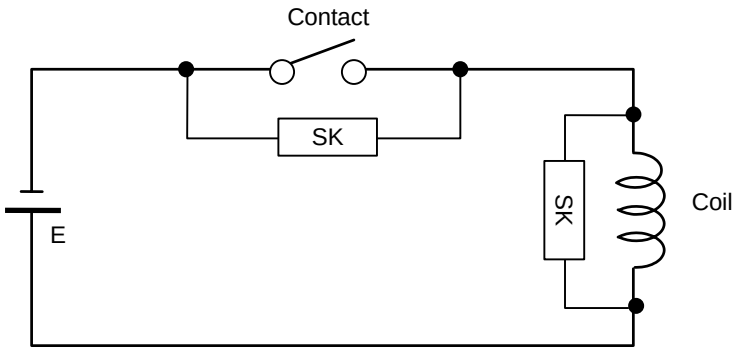
(1) Peel off part of the cable sheath and expose the shield as shown in the drawing. Press the exposed part against the grounding plate with the cable clamp fittings.
(2) If the cable is thin, clamp several together in a bunch.
(3) Use adequate force when tightening the cable so that the wire material is not damaged.
(4) Connect each grounding plate together and ground them at one point.
(5) Refer to APPENDIX 6 about the outline drawing of clamp fittings and grounding plate.

The cables connected to the control unit for which the shield must be connected to the ground are shown below.

Unit name	Connector name	Application/function	Cable shield treatment
Control unit (FCU6-MU043) (FCU6-MU042) (FCU6-MU041)	SERVO1	Servo drive unit/spindle drive unit	Required
	SERVO2	Auxiliary axis	Required
	HANDLE	Manual pulse generator	Required
	ENC	Synchronous feed encoder	Required
	SIO	RS-232C	Required
	TERMINAL	Communication terminal	Required
	SKIP	Sensor signal	Required
	DIO	Machine input/output signal	Not required
	RIO-M	Remote I/O unit	Required
	RIO-M/S	Remote I/O unit	Required

3.4.3 Connection of Spark Killer

The noise generated when the coil/contact operates must be removed.
As a countermeasure, connect a spark killer in parallel with the coil/contact.



The CR compound element is effective in removing the noise generated due to magnetic induction.

Spark killer	C: 0.033 to 0.1μF
	R: 10 to 120Ω

3.4.4 Countermeasures against Lightning Surge Protection

Generally, lightning surge infiltrates the control power supply from the power supply line. This control power supply or the internal circuit can be damaged by lightning surge via the control power supply.
If this countermeasure is not taken throughout the control panel as shown in Fig. 1, the lightning surge could flow over the signal line and damage the other devices.

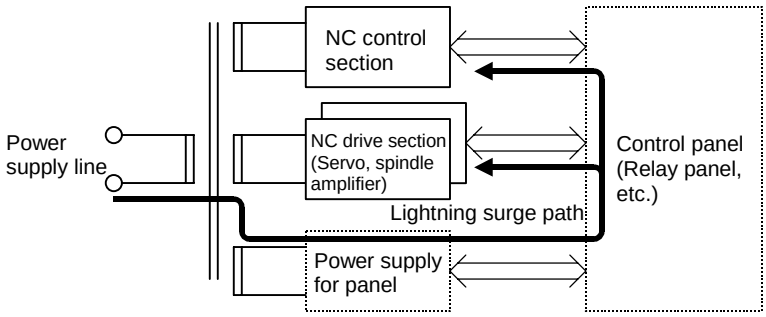


Fig. 1 Path of damage caused by lightning surge

(1) Protective measures

Install the surge absorber on the power supply line for the separately prepared power supply units, etc., as shown in Fig. 2 and Fig. 3.
The following two countermeasures are required as protection against general damage.

1) Installation of surge absorber
2) Installation of circuit protector

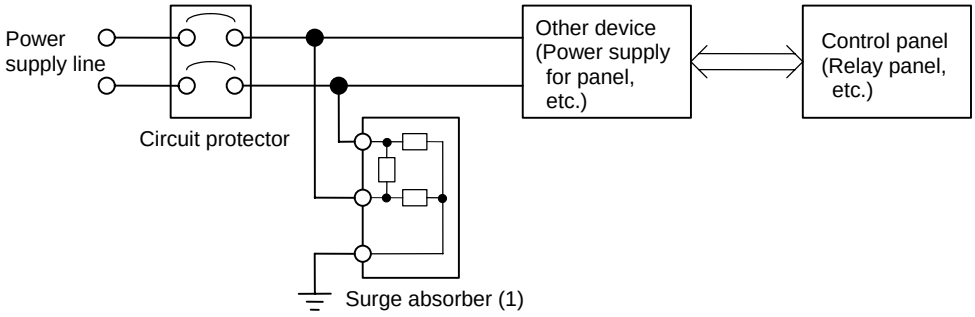


Fig. 2 Lightning surge countermeasures for single-phase power supply line

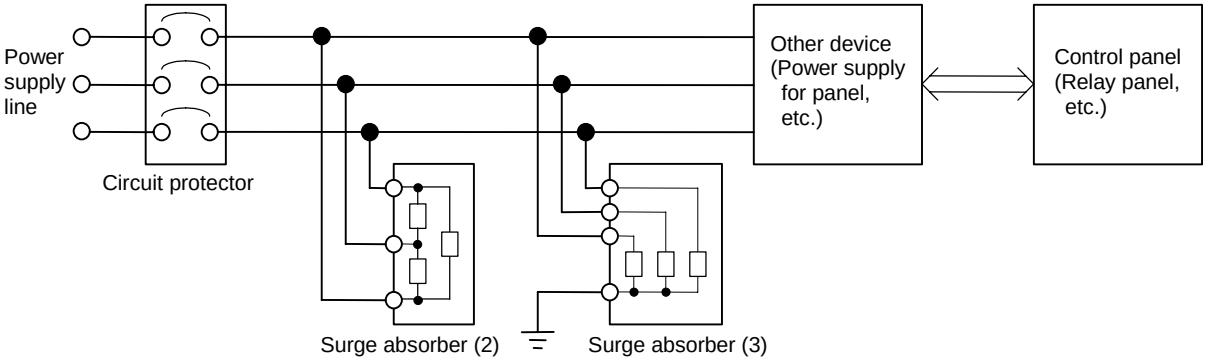


Fig. 3 Lightning surge countermeasures for 3-phase power supply line

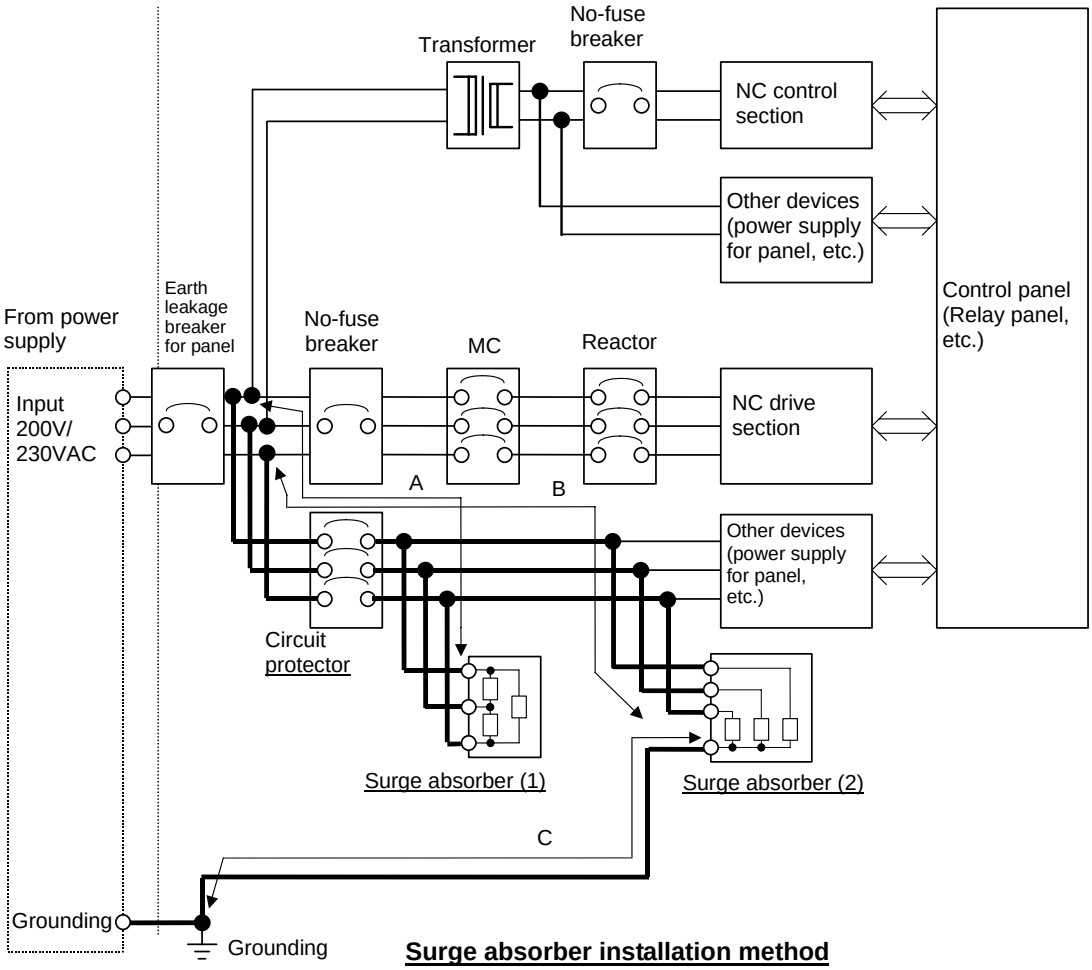
(2) Examples of surge absorbers

Types of Okaya Electric surge absorbers

Surge absorber	Type	Circuit voltage [Vrms]	Max. tolerable circuit voltage [Vrms]	Clamp voltage [V] ±10%	Surge resistance level 8/20μs [A]	Surge withstand voltage (Electrical-discharge start voltage) 1.2/50μs [V]
(1)	RAV-781BWZ-4	250	500	700	2500	2k
(2)	RAV-781BYZ-2	250	300	783	2500	20k
(3)	RAV-781BXZ-4	250	500	700	2500	2k

* Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

(3) Surge absorber installation method



Surge absorber installation method

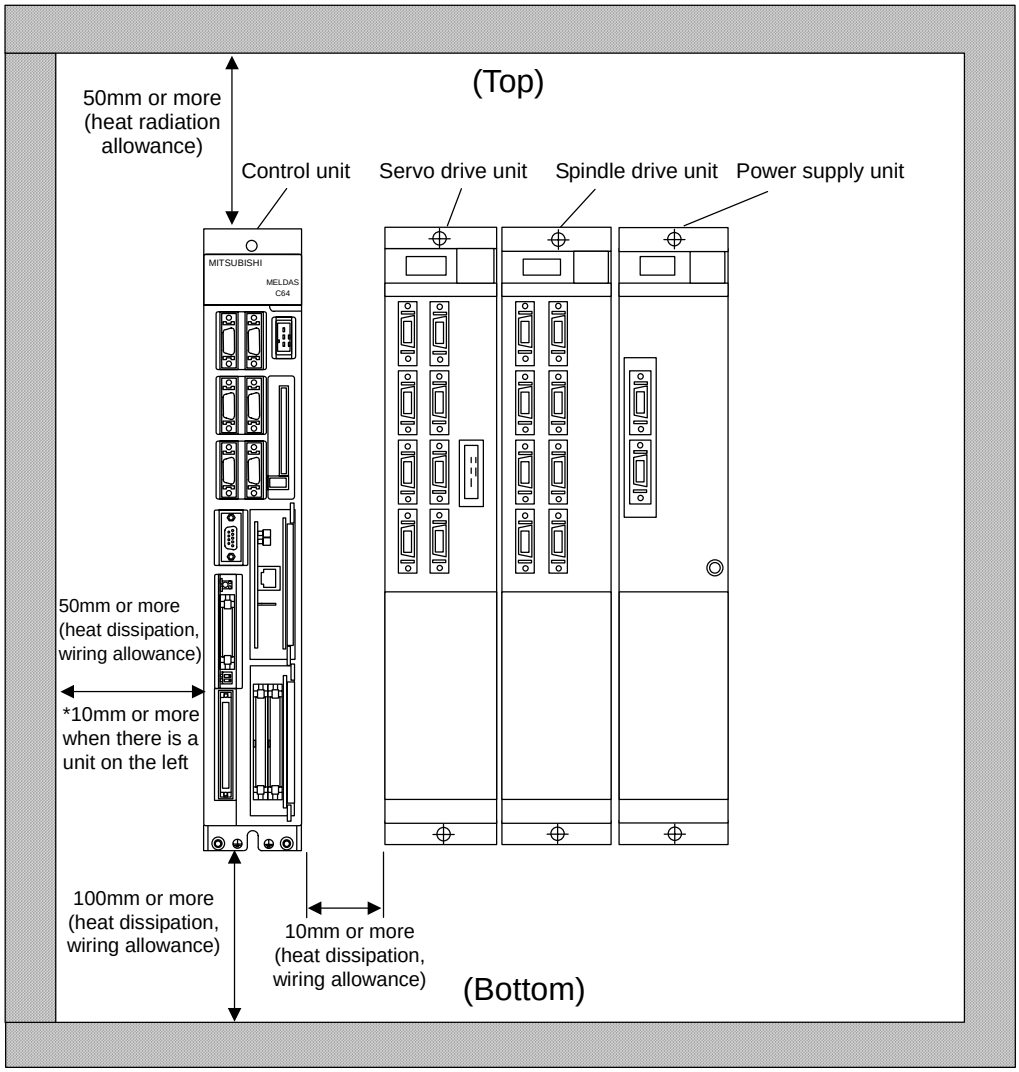
Precautions

1) Thick wiring enhances the lightning surge absorbing effect, so make the wiring as thick and short as possible.
   Wire material : Wire diameter 2mm^2 or more
   Wire length : Connection to surge absorber (1): Wire length (A) is 2m or less
   Connection to surge absorber (2): Wire length (B) is 2m or less
   Grounding to surge absorber (2) : Wire length (C) is 2m or less
2) When carrying out a dielectric voltage-withstand test on the power supply line, remove surge absorber (2) as the surge absorber will function with the applied voltage.
3) A short-circuit accident will occur if a surge exceeding the tolerance is applied on the surge absorber. Thus, always insert a circuit protector to protect the power supply line.
   The current does not flow constantly to surge absorbers (1) and (2), so the circuit protector can also be used for the other devices.

3.5 Installation

Each unit is installed in the sealed structure cabinet as a principle. When installing into the cabinet, refer to the following drawings to consider the control unit's heat radiation and wiring, and secure enough space for ventilation.

(1) Install each unit vertically so that the front is visible.
(2) Refer to the following drawings to consider the control unit's heat radiation and wiring, and secure enough space for ventilation.



(Note) The right side of the control unit will temporarily expand by approx. 2mm when the expansion card is inserted and removed.
It will not be possible to insert or remove the expansion card if there is no space between the control unit and adjacent unit. Always provide sufficient space.

⚠ CAUTION

⚠ Install the control unit and communication terminal on noncombustible material. Installation directly on or near combustible material may lead to fires.

⚠ Always observe the installation direction.

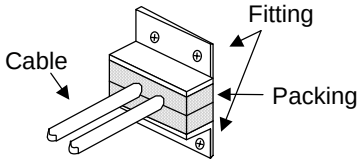
⚠ Do not install or operate a control unit or communication terminal that is damaged or that has missing parts.

⚠ The control unit and communication terminal are precision devices so do not drop or apply strong impacts on them.

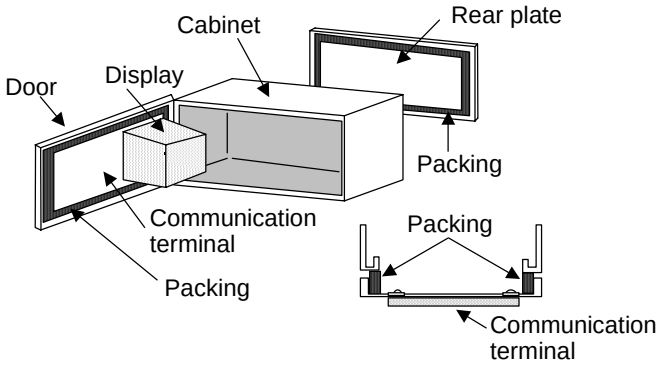
3.6 Mounting Conditions

(1) Parts, highly susceptible to dust, are mounted with a high density inside the unit.
Always use a sealed structure for the cabinet, and provide the following treatments.

- Always plug the cable inlet with packing to prevent dust and oil from entering.
- Take care so that outdoor air does not enter the heat radiation holes, etc.
- Plug all clearances.
- Always install door packing.
- If there is a back lid, always install packing.
- Oil will easily accumulate at the ceiling, and can enter the cabinet from the screw holes. Always take special countermeasures such as using oil-preventing packing.
- Packing is attached to the installation surface of the communication terminal and ready to use.



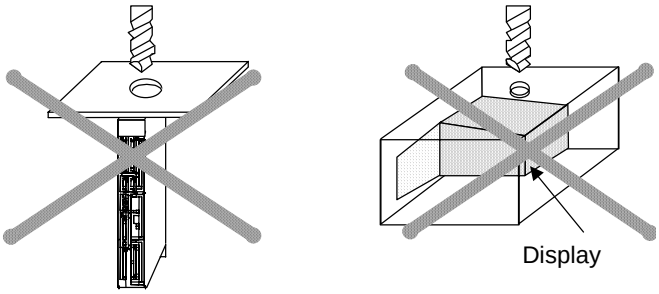
Cable inlet (Example)



⚠ CAUTION

⚠ Install the communication terminal where it will not be subjected to cutting oil.

(2) Avoid machining in the area after installing each unit. Cutting chips, etc., could get on the electronic parts and cause damage.



⚠ CAUTION

⚠ Do not allow conductive foreign matter such as screws or metal chips or combustible foreign matter such as oil enter the control unit or communication terminal.

(3) Design so that the cabinet's internal temperature will not exceed the ambient temperature by 10°C or higher, and so that the control unit and communication terminal, etc., are within the temperature conditions. (Refer to Section 4.3 for details.)
Avoid installing the cabinet where the surface temperature of the communication terminal could reach 45°C or more.

(4) The CRT display may not operate correctly because of external magnetic fields. Separate sources of magnetic fields (transformer, fan, magnetic switcher, solenoid relay, magnet stand, magnetized workpiece, power lines with large currents, etc.) at least 200mm or more away from the CRT display. Note that the magnetic fields generated by these sources are each different, and will also differ depending on the installation direction. Thus, correct operation may not be possible even if the source is separated by 200mm or more. When determining the layout of magnetic field generating sources, consider the direction that the field is generated, and confirm with the actual machine.

3.7 Turning the Power ON Again

When turning the control unit power ON again after turning it OFF, wait at least five seconds or more. If the power is turned ON in less than five seconds, the system may not start up.

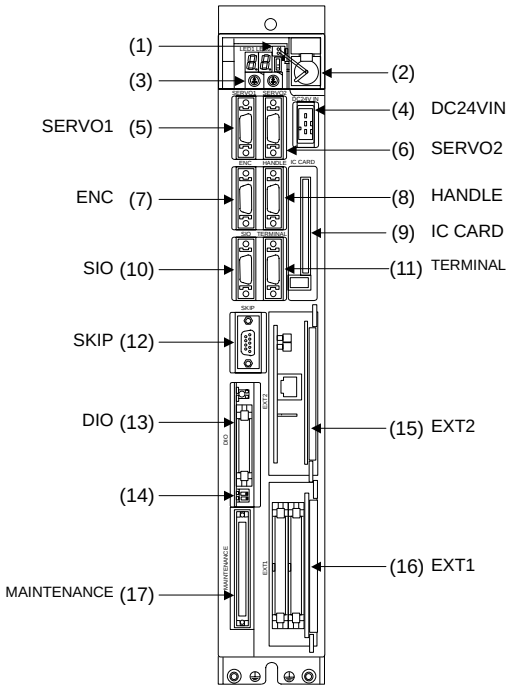
4. CONTROL UNIT CONNECTIONS

The methods for connecting to each unit and device from the control unit are briefly explained in this section.

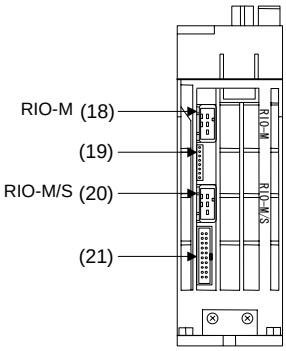
4.1 Names of Each Control Unit Part

(1) Battery connection connector
(2) Battery
(3) Display unit rotary switch
(4) 24VDC input connector
(5) Connector 1 for servo drive unit connection
(6) Connector 2 for servo drive unit connection
(7) Synchronous feed encoder connection connector
(8) Manual pulse generator connection connector
(9) IC memory card holder
(10) RS-232C/RS-422 device connection connector
(11) Communication terminal connection connector
(12) Sensor signal (skip) connection connector
(13) Digital signal input/output connector
(14) Terminator ON/OFF switch
(15) Extension slot 2
(16) Extension slot 1
(17) Maintenance connector (for memory card)
(18) Remote I/O master station connector
(19) Mitsubishi testing connector
(20) Remote I/O master, slave station connector
(21) Mitsubishi testing connector

Front view



Bottom view

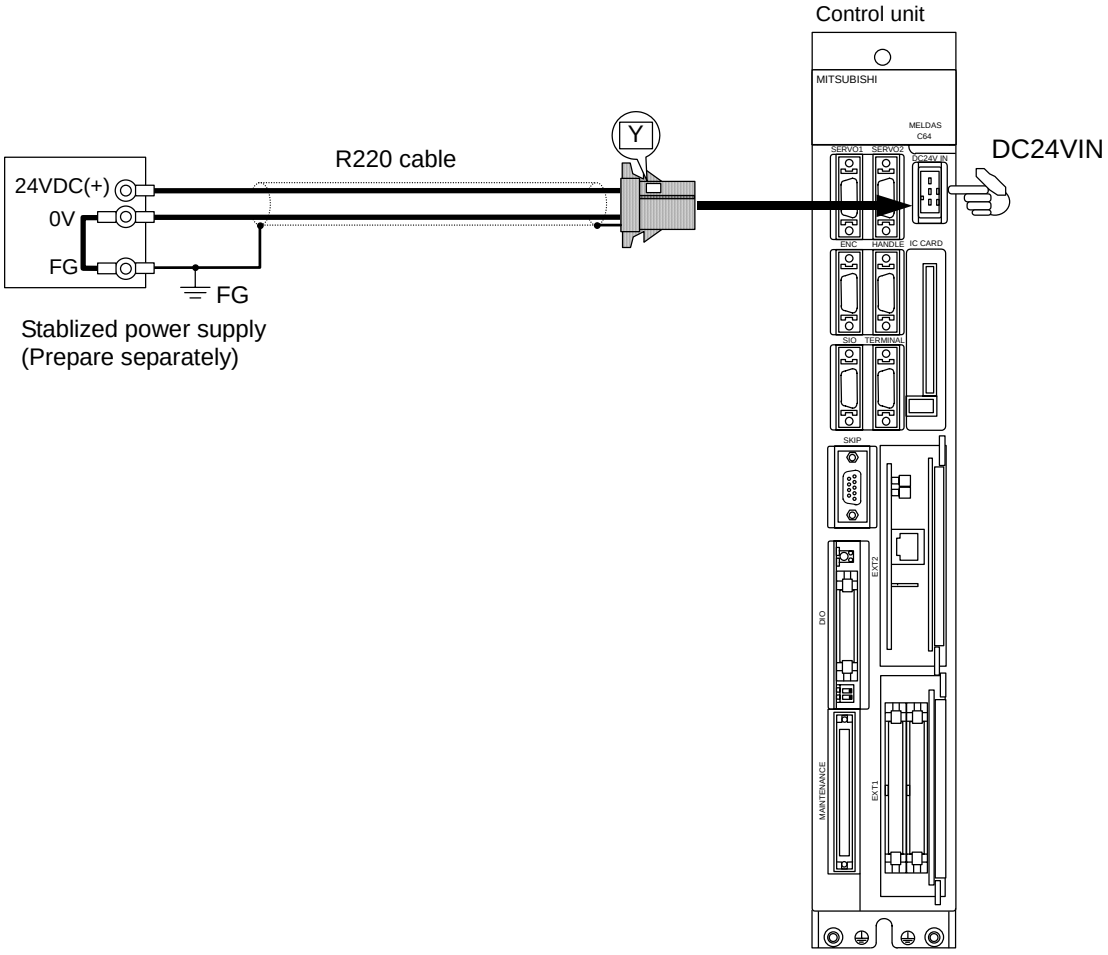


(Note 1) The drawing option card shows the case with the Ethernet card and extension DIO card mounted.

4.2 Connecting the Power Supply

A 24VDC power supply is required for the control unit. Prepare a stabilized power supply that satisfies the following conditions. The DC24VIN connector is used to connect the power supply. Use the CN220 connector set (optional, with one end) when manufacturing the R220 cable. (Refer to the CABLE MANUFACTURING DRAWINGS for details.)

Output voltage	24VDC ±5%
Ripple	±5% (p-p)
Maximum output current	3.0A or more

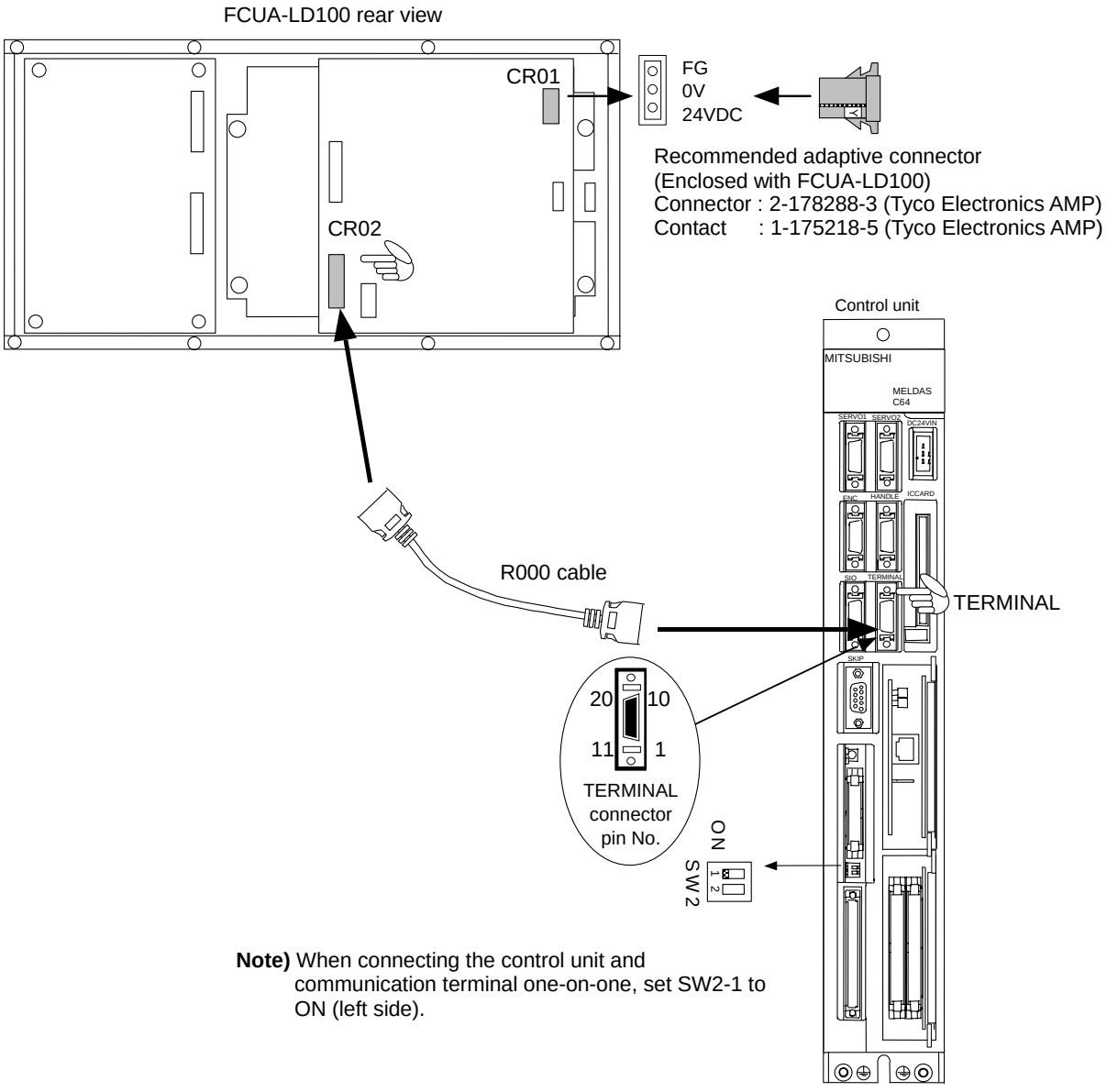


⚠ CAUTION

- **⚠ Separate the signal wire from the drive line/power line when wiring.**
- **⚠ Do not apply a voltage other than that specified in this manual onto the connector. Failure to observe this could lead to rupture or damage.**
- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**

4.3 Connecting the Communication Terminal

The TERMINAL connector is used to connect the communication terminal (FCUA-LD100, etc.). On the communication terminal side, connect the R000 cable to the CR02 connector, and supply the 24VDC power supply to the CR01 connector.
Use the enclosed connector and contact to supply the +24VDC power supply. If the accessories are insufficient, prepare the one-ended CN220 connector set (optional, with one end). (Refer to the cable manufacturing drawings for details.)
When connecting the communication terminal and control unit one-on-one as shown below, confirm that the switch SW2-1 under the DIO connector of the control unit is set to ON (left side).



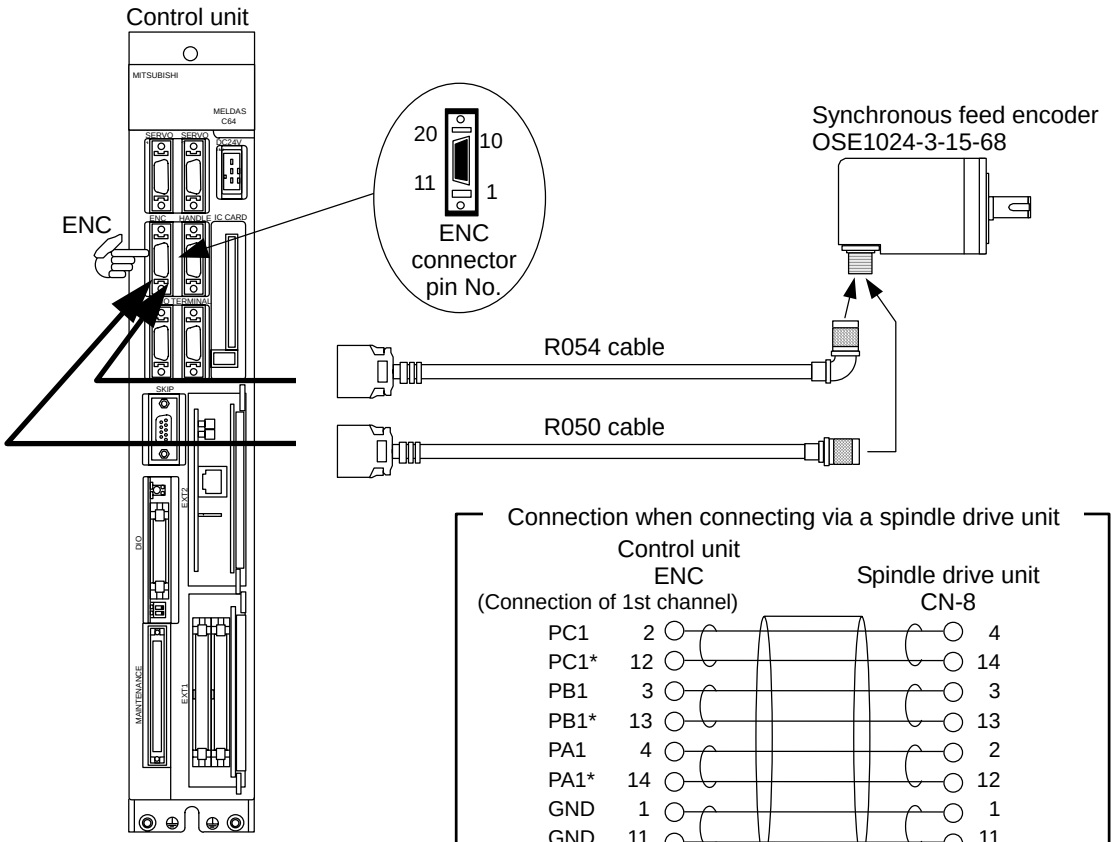
Note) When connecting the control unit and communication terminal one-on-one, set SW2-1 to ON (left side).

⚠ CAUTION

- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.**

4.4 Connecting the Synchronous Feed Encoder

The ENC connector is used to connect the synchronous feed encoder. Use the CS050 or CS054 connector set (optional, with both ends) when manufacturing the R050 or R054 cable. (Refer to the cable manufacturing drawings for details.)
Note that the synchronous feed encoder may be connected via the spindle drive unit.



Connection when connecting via a spindle drive unit

Control unit ENC (Connection of 1st channel)		Spindle drive unit CN-8
PC1	2	4
PC1*	12	14
PB1	3	3
PB1*	13	13
PA1	4	2
PA1*	14	12
GND	1	1
GND	11	11
(Connection of 2nd channel)		
PC2	7	4
PC2*	17	14
PB2	8	3
PB2*	18	13
PA2	9	2
PA2*	19	12
GND	5	1
GND	15	11

Recommended adaptive connector
Connector: 10120-3000VE (Sumitomo 3M)
Case: 10320-52F0-008 (Sumitomo 3M)

<Caution>
- The wire material shall be a shielded stranded cable equivalent to AWG22(0.3mm^2) compliant with the UL1061-2464 standards. The shield shall be connected to the connector case's GND plate.
- This cable is not available from Mitsubishi.

⚠ CAUTION

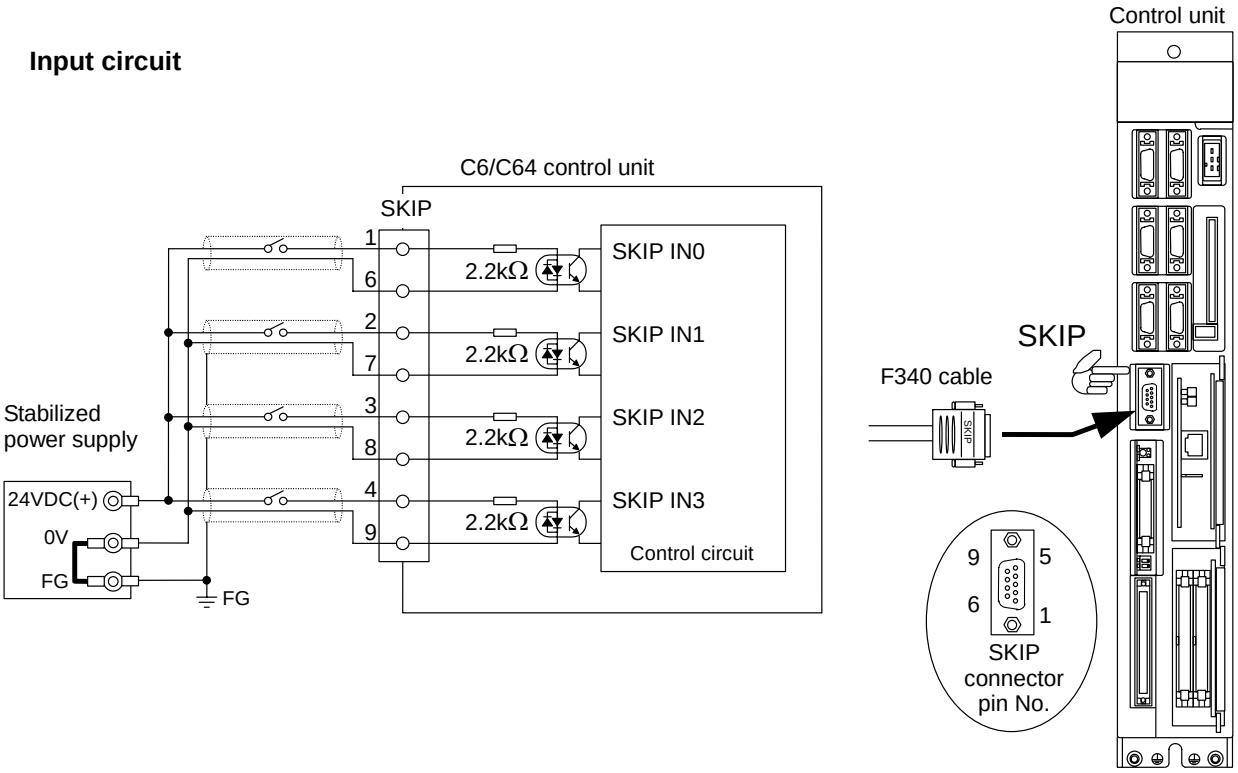
⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.

⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.

4.5 Connecting the Sensor Signal (skip)

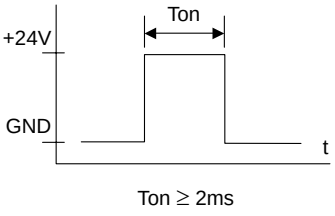
The SKIP connector is used to connect the sensor signal (skip).
The sensor signal is used for high-speed signal processing, so take special care to prevent noise induction, etc., from occurring. If the cable is long, always use a shielded wire.
Note that the input conditions, such as the input signal holding time, differ from the machine input/output signal's input conditions.

Input circuit



Input conditions

1	Input voltage when external contact is ON	18V or more
2	Input current when external contact is ON	9mA or more
3	Input voltage when external contact is OFF	4V or less
4	Input current when external contact is OFF	1mA or less
5	Input signal holding time (Ton)	2ms or more
6	Internal response time	0.08ms or less
7	Machine side contact capacity	30V or more, 16mA or more

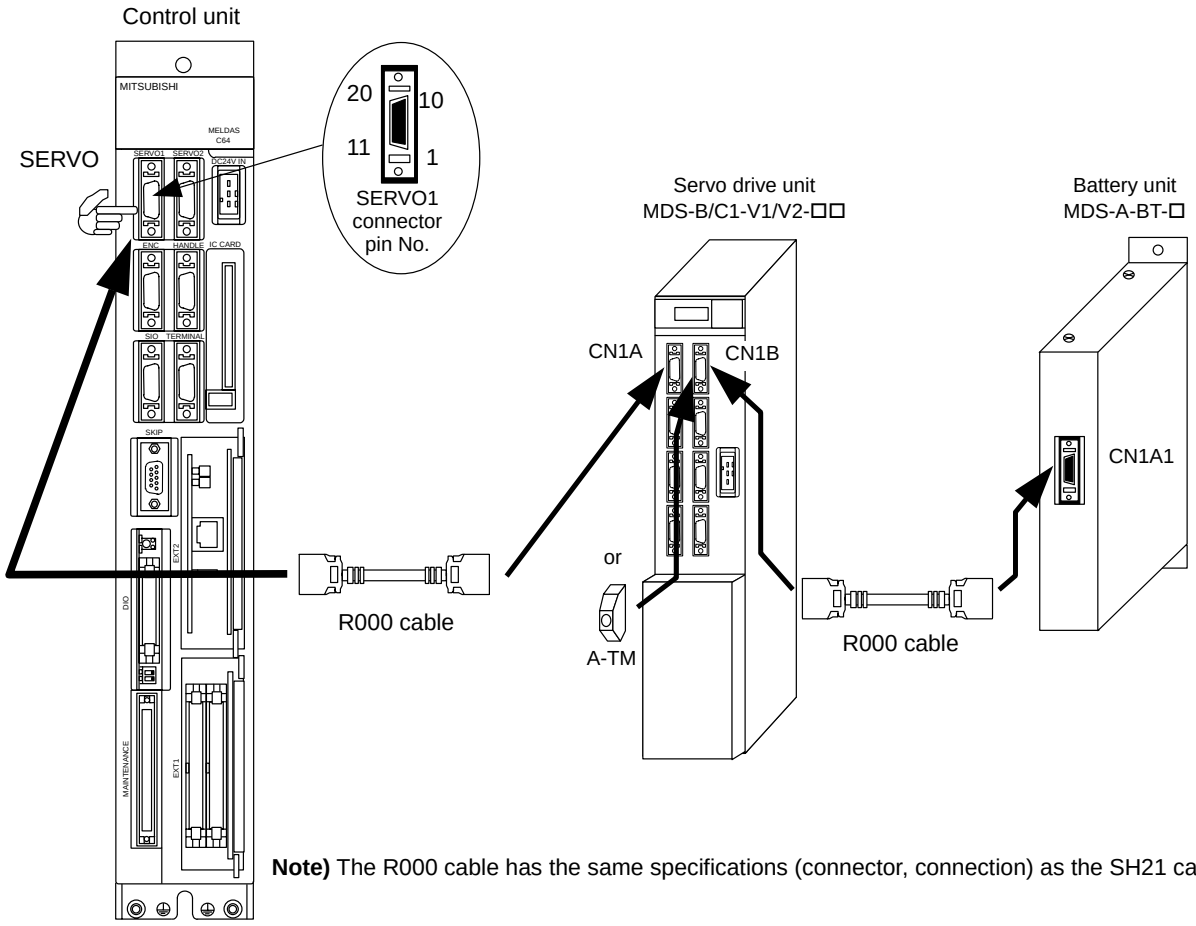


⚠ CAUTION

- **Do not apply a voltage other than that specified in this manual onto the connector. Failure to observe this could lead to rupture or damage.**
- **Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **Do not connect or disconnect the connection cable between each unit while the power is ON.**

4.6 Connecting the Servo Drive Unit

The SERVO1 connector is used to connect the servo drive unit. Connect the R000 cable from SERVO1 connector on the control unit to CN1A connector on the servo drive unit.
Depending on the specifications, the SERVO2 connector may be used.
When using multiple servo drive units, or when connecting in parallel with the spindle drive unit, connect the R000 cable from CN1B connector to CN1A connector on the next drive unit.
On the drive unit that is the final axis, connect the A-TM (terminator) to CN1B connector.
When using the absolute position specifications, connect the battery unit with the R000 cable instead of the A-TM.
Use CS000 connector set (optional, with both ends) when manufacturing the R000 cable. (Refer to the cable manufacturing drawings for details.)
Refer to the "MDS-C1 Series Specifications Manual" for details on connecting with the servo drive unit.



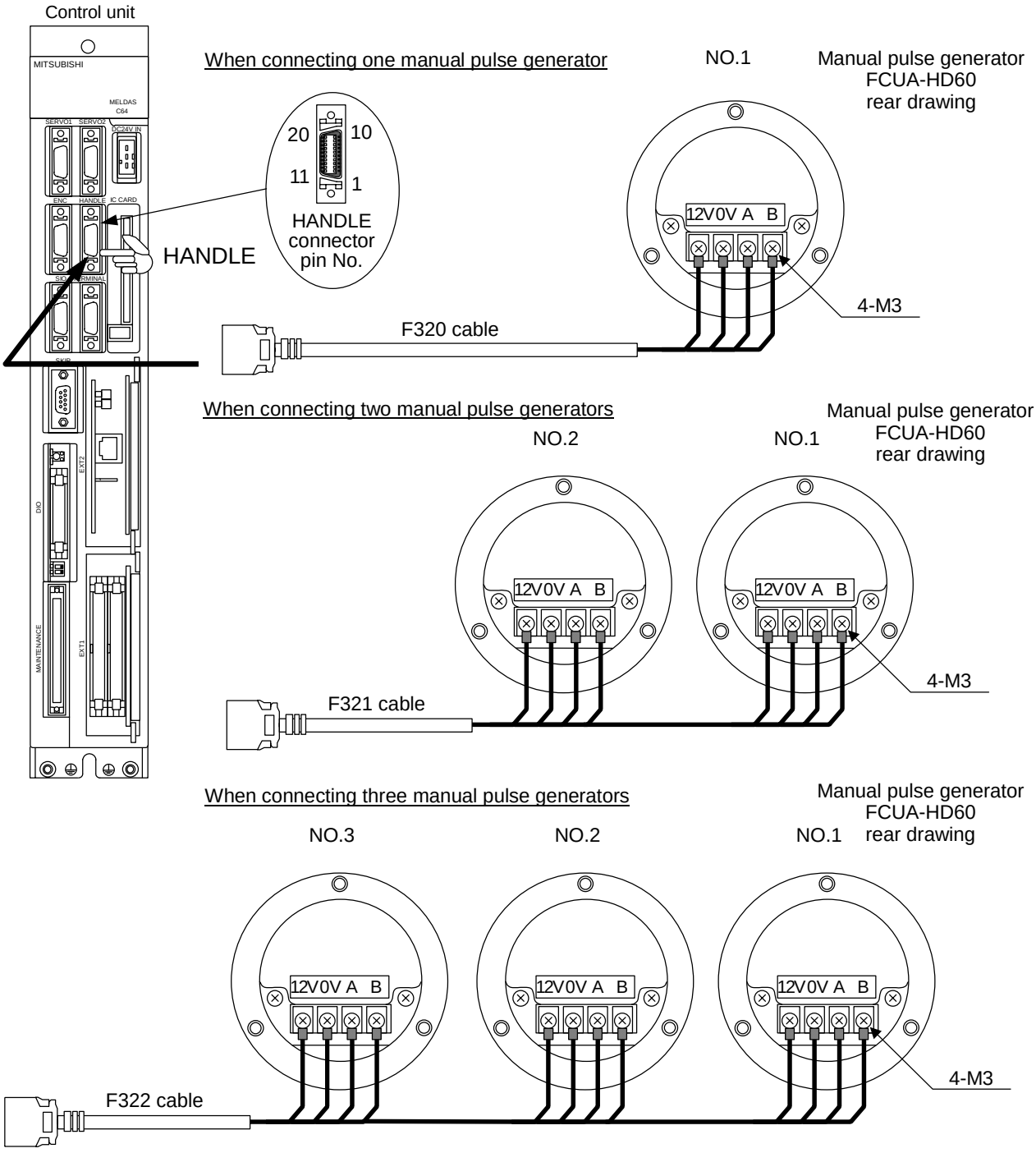
Note) The R000 cable has the same specifications (connector, connection) as the SH21 cable.

⚠ CAUTION

- ⚠ **Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- ⊘ **Do not connect or disconnect the connection cable between each unit while the power is ON.**

4.7 Connecting the Manual Pulse Generator

The HANDLE connector is used to connect the manual pulse generator. Up to three manual pulse generators can be connected. Use the CS000 connector set (optional, with both ends) when manufacturing the F320, F321 or F322 cable. (Refer to the cable manufacturing drawings for details.)



⚠ CAUTION

- **Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **Do not connect or disconnect the connection cable between each unit while the power is ON.**

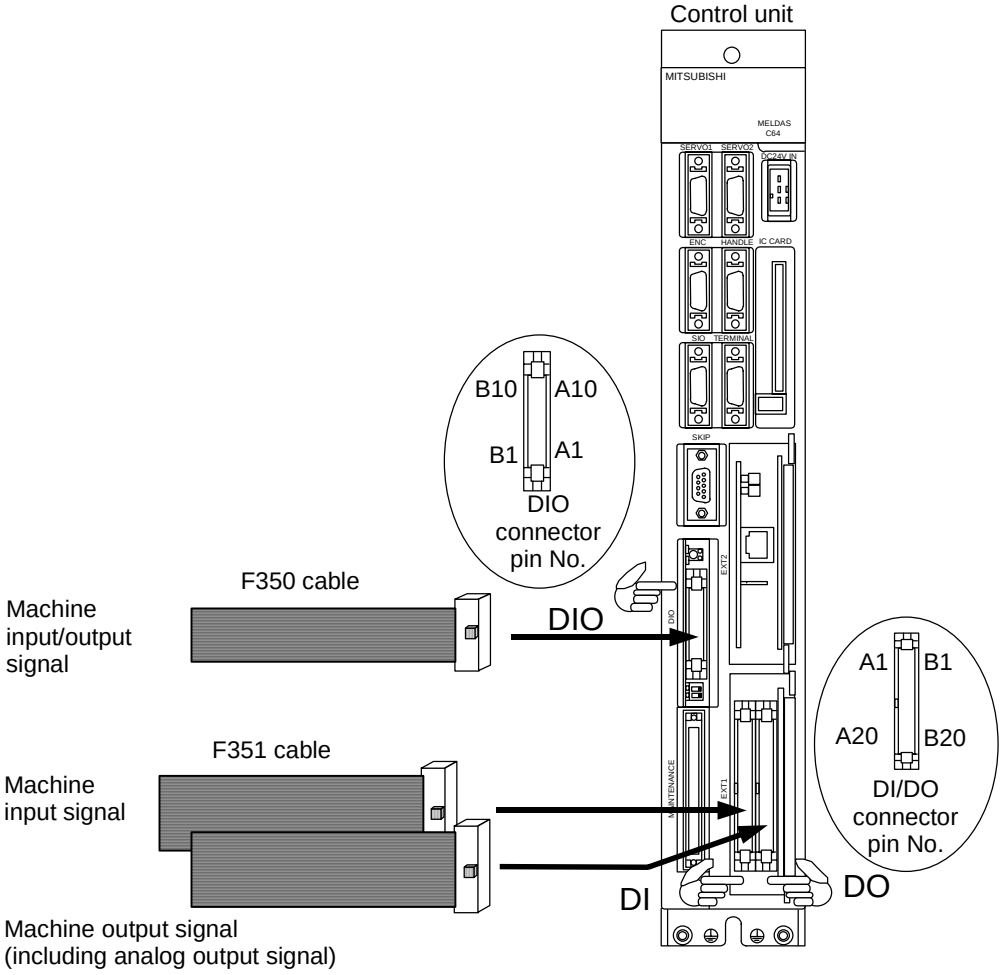
4.8 Connecting the Machine Control Signal

Machine input/output signal types and No. of points

	Input	Output	Analog output
Standard control unit	16 points **(Note 1)**	1 point **(Note 2)**	–
Extension DIO card (option mounted)	32 points	32 points	1 point

(Note 1) Includes one EMG (emergency stop signal) input point.
(Note 2) Uses as the SA (servo READY) output.

The DIO connector is used to connect the machine input/output signal.
This connector is also used for the emergency stop signal input and SA (servo READY) output.
Up to two extension DIO cards can be added by mounting with the option.

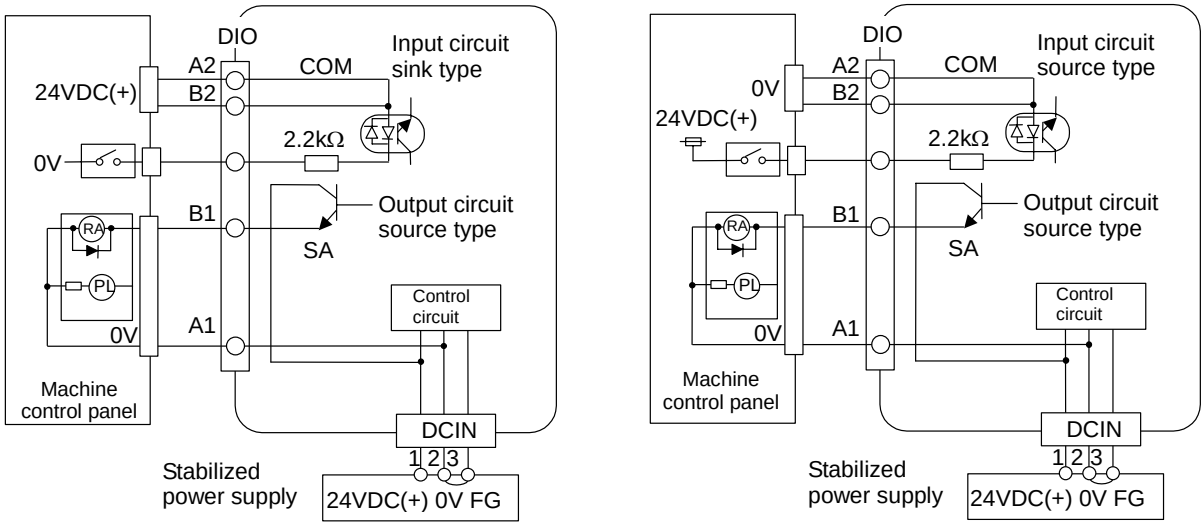


⚠ CAUTION

⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.

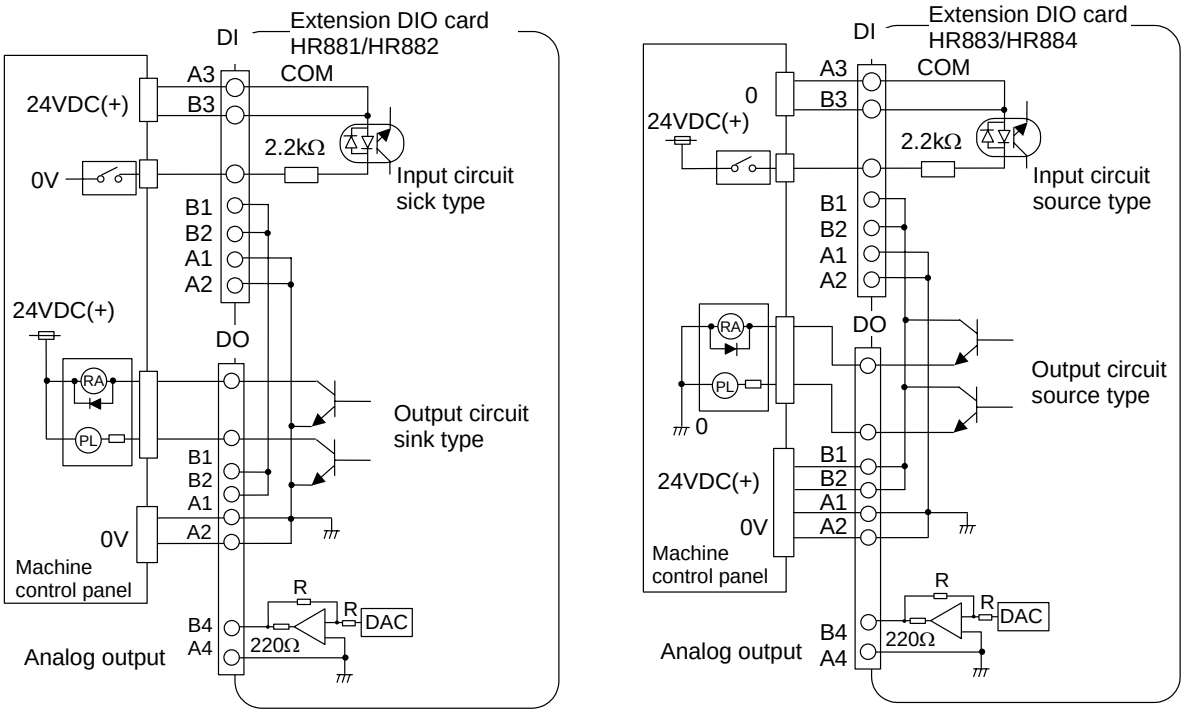
⃠ Do not connect or disconnect the connection cable between each unit while the power is ON.

<Outline of connection>



(Note 1) Only the machine input signal can be changed between the sink type and source type.

<Outline of extension DIO card connection>

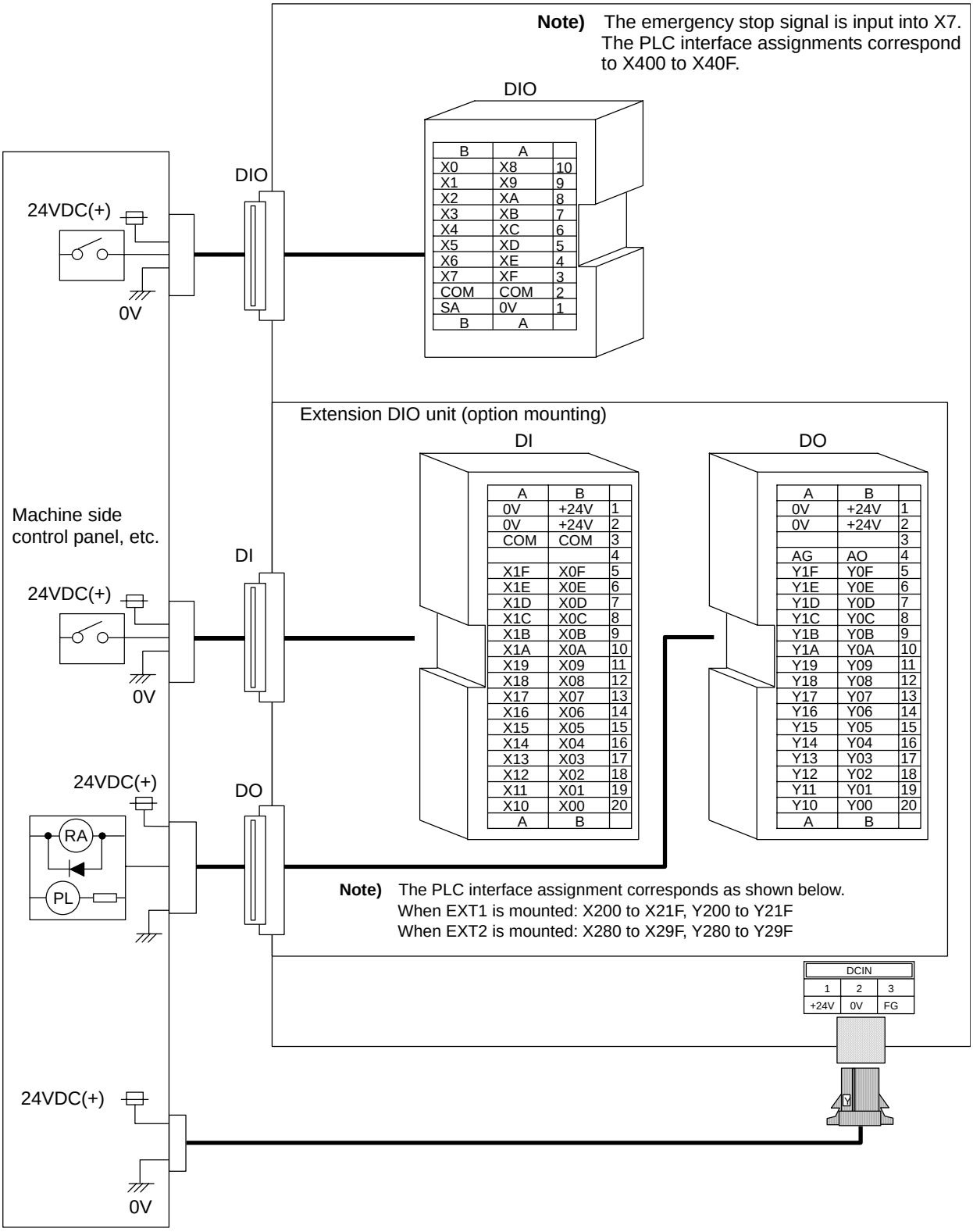


⚠ CAUTION

⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.

⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.

<Signal assignment table>



<Applicable connector>

DIO

Crimp type connector : 7920-6500SC
Strain relief : 3448-7920
Maker : Sumitomo 3M

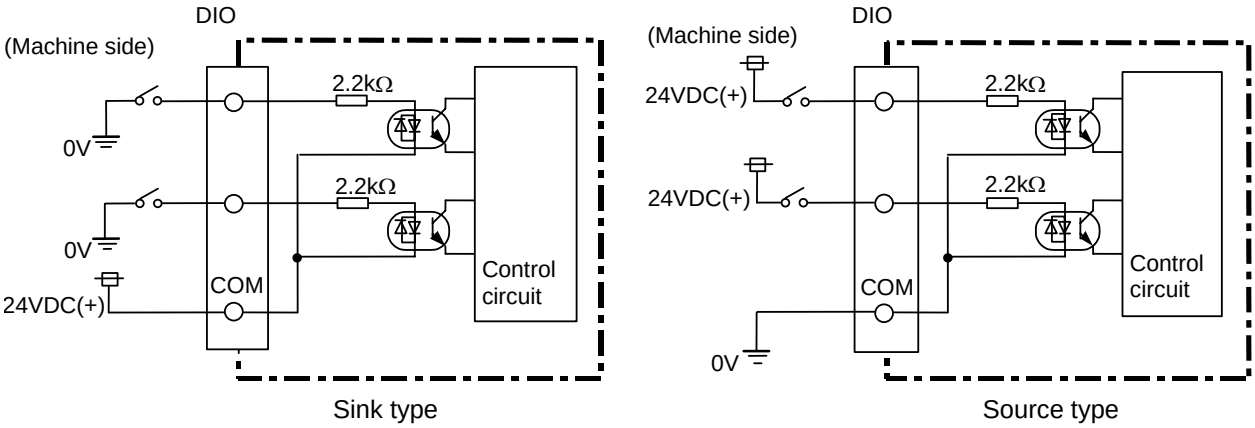
DI/DO

Crimp type connector : 7940-6500SC
Strain relief : 3448-7940
Maker : Sumitomo 3M

<Outline of input circuit>

The digital signal input circuit includes the sink type and source type. These can be selected by each connector unit.

Input circuit



Input conditions

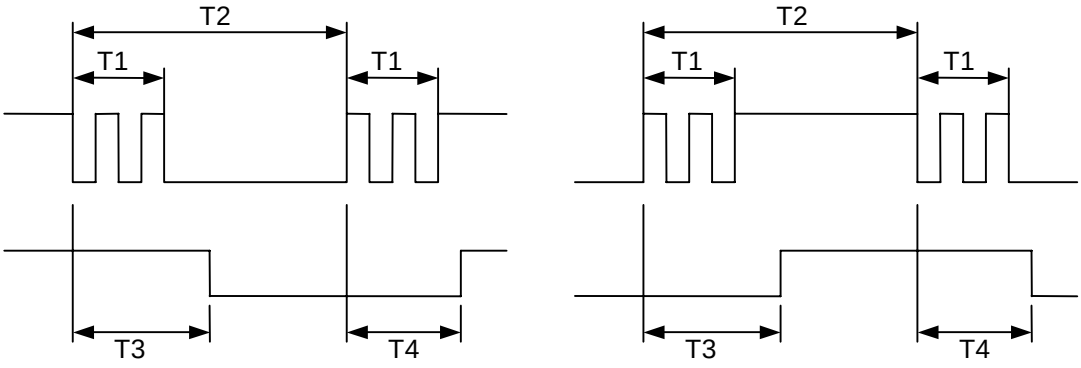
The input signal must be used within the following condition range.

Sink type

Input voltage at external contact ON	6V or less
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	20V or more
Input current at external contact OFF	2mA or less
Tolerable chattering time	2.2ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2 below)
Input circuit operation delay time	2.2ms ≤ T3≒T4 ≤ 16ms
Machine side contact capacity	30V or more, 16mA or more

Source type

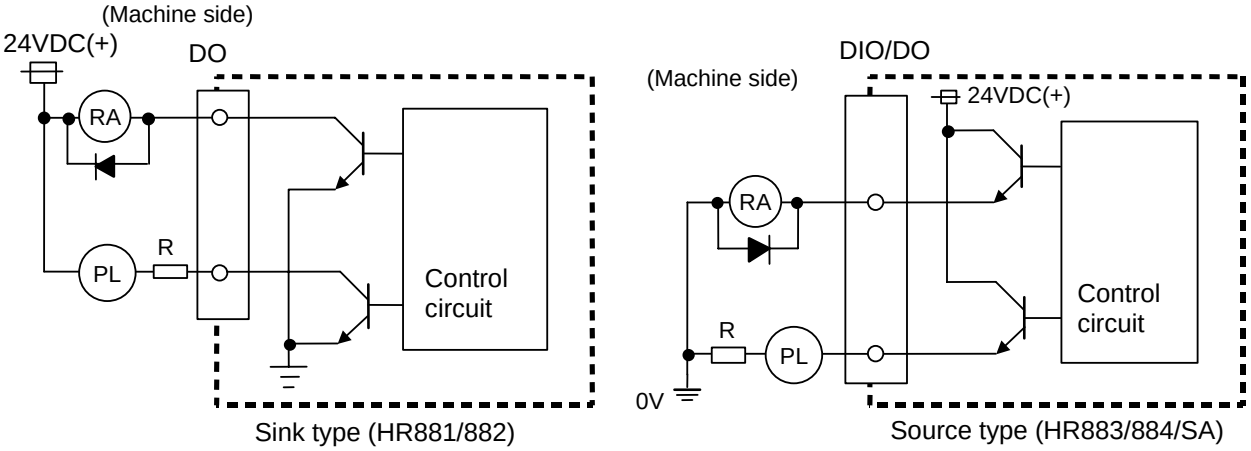
Input voltage at external contact ON	18V or more
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	4V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	2.2ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2 below)
Input circuit operation delay time	2.2ms ≤ T3≒T4 ≤ 16ms
Machine side contact capacity	30V or more, 16mA or more



<Outline of output circuit>

There are a sink type (HR881/882) and source type (HR883/884) digital signal output circuits. The SA (servo READY) output circuit is a source type. Use within the following specifications range.

Output circuit



Output conditions

Insulation method	**Non-insulated**
Rated load voltage	24VDC
Maximum output current	60mA
Output delay time	40μs

<CAUTION>

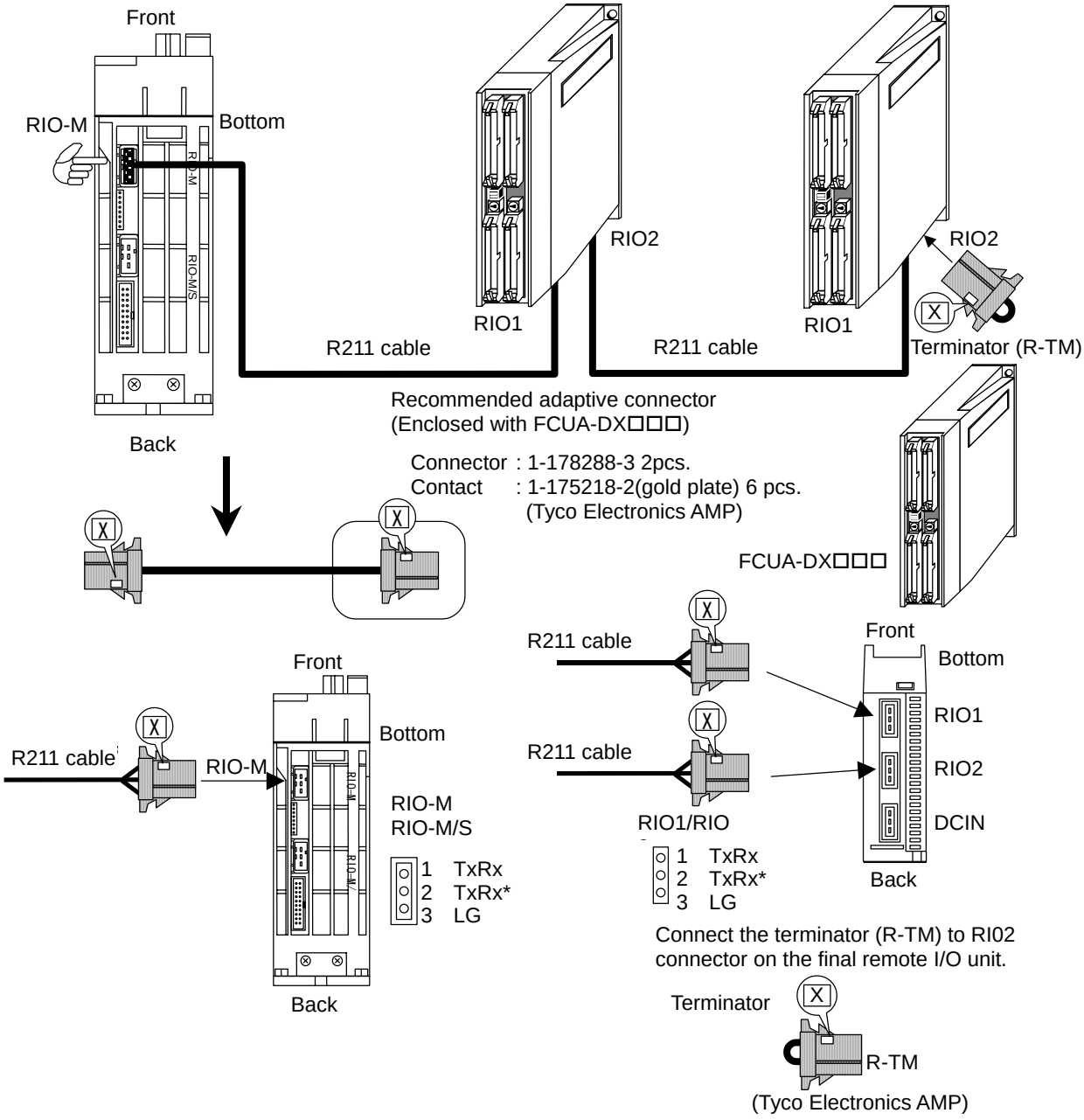
When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, 100mA or more) in parallel to the load. Note that the device could be damaged if the diode's direction is incorrect.
When using a capacity load such as a lamp, always connect a protective resistor (R = 150Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the instantaneous current.)

⚠ CAUTION

- **When using an inductive load such as relays, always connect a diode in parallel to the load as a noise countermeasure.**
- **When using a capacitive load such as a lamp, always connect a protective resistor in series to the load to suppress rush currents.**

4.9 Connecting the Remote I/O Unit

The RIO-M connector is used to connect the remote I/O unit. Connect the R211 cable from the RIO-M connector on the control unit to RIO1 on the remote I/O unit.
When connecting multiple remote I/O units, connect the R211 cable from the RIO2 connector to the RIO1 connector on the next remote I/O unit.
Connect the terminator (R-TM) to RIO2 connector on the final remote I/O unit. Use the accessories for the connectors and contacts when manufacturing the R211 cable. If the accessories are insufficient, prepare the CN221 one end connector set (optional, with one end).
(Refer to the CABLE MANUFACTURING DRAWINGS for details.)



⚠ CAUTION

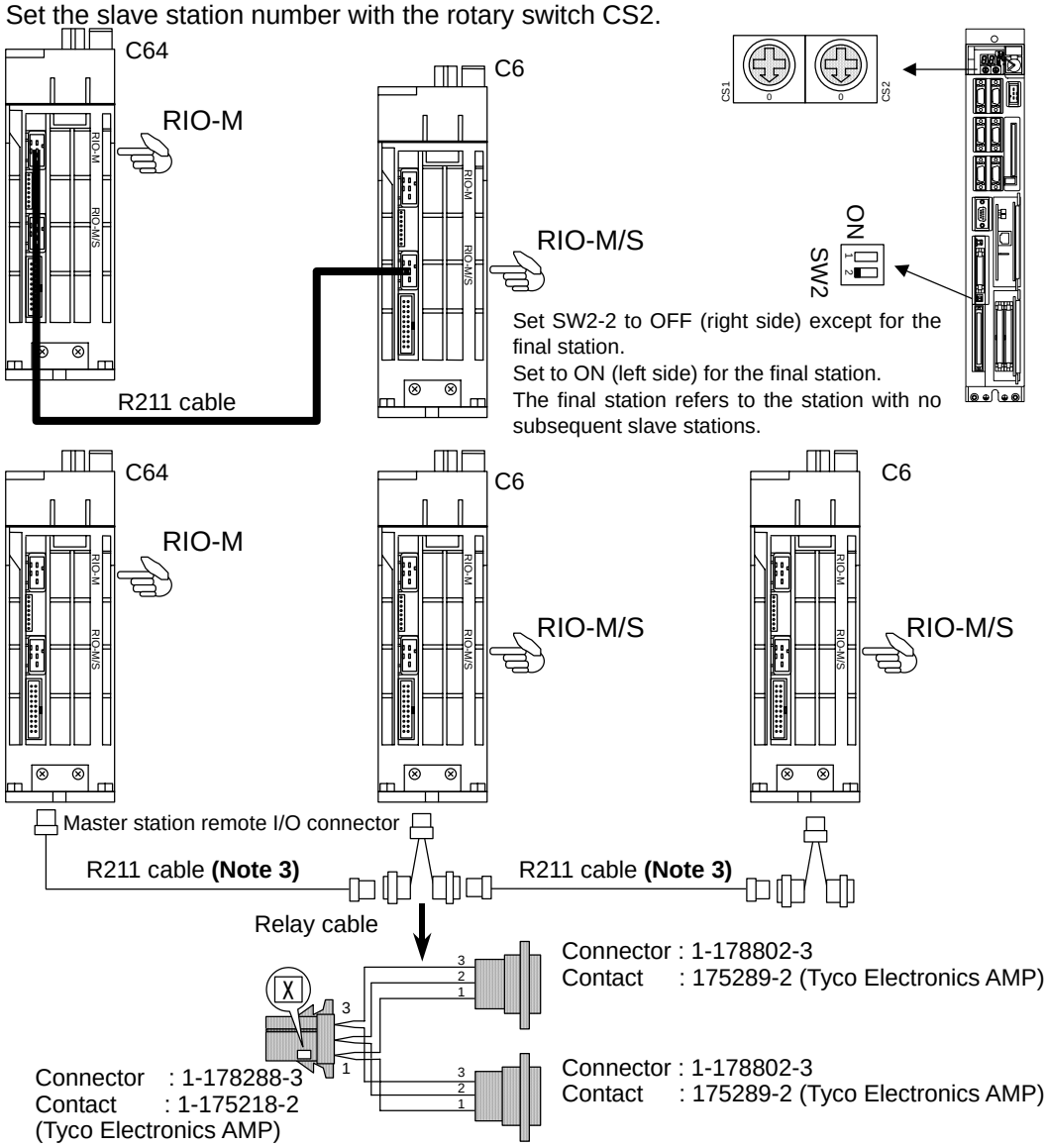
- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.**
- **⚠ Separate the signal wire from the drive line/power line when wiring.**

<Connection to use C6 as slave station>

When using the C64 and M600 Series, etc., as the master station and C6 as the slave station, use the RIO-M/S connector. Connect the R211 cable from the master station to the RIO-M/S connector on C6.

When connecting multiple C6 units, use a relay cable or terminal block, etc., as a relay. Set the terminator ON/OFF slide switch SW2-2.

Set the slave station number with the rotary switch CS2.



(Note 1) The maximum number of C6 control units and remote I/O units that can be connected is within the range that the total number of occupied stations (channels) is 8 or less.
(Note 2) Set the C6 control unit slide switch SW2-2 to ON (left side) only for the final station.
(Note 3) Connect the crimp terminal connected to the shield of the R211 cable to the frame ground of the control unit.
Note that to improve the noise withstand level, there may be cases when one end, both ends or neither end is connected.
(Note 4) The RIO-M connector is dedicated for the master station, and RIO-M/S changes between the master and slave with parameter settings.
When using as a slave station, the parameter must be set for the slave.

⚠ CAUTION

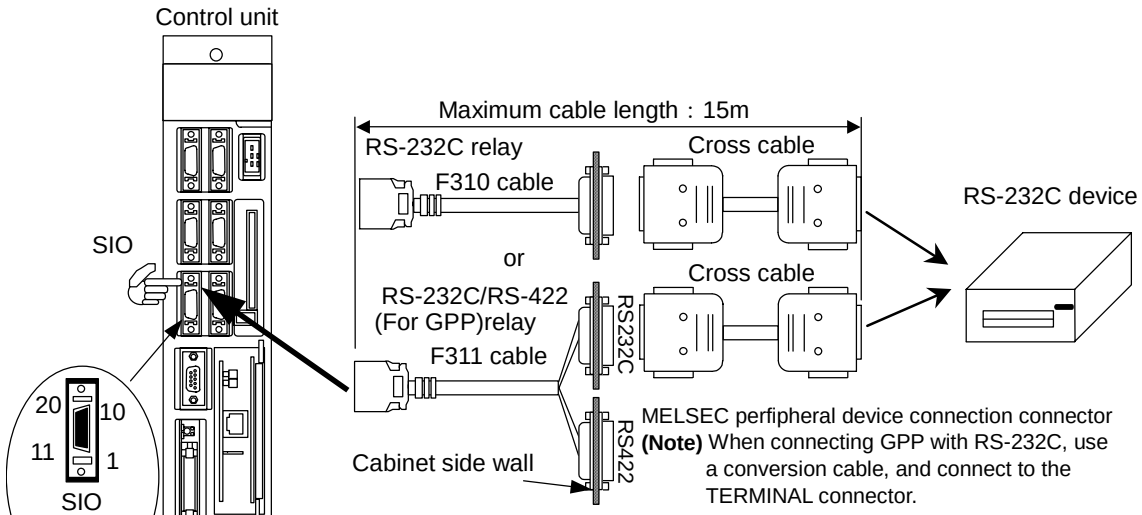
⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.

⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.

⚠ Separate the signal wire from the drive line/power line when wiring.

4.10 Connecting the RS-232C Device

The SIO connector is used to connect the RS-232C device (serial I/O).
The F310 and F311 relay cables are required to connect the RS-232C cable. (Refer to the CABLE MANUFACTURING DRAWINGS for details.)



The specifications of the cross cable are shown below.

Cross cable connection

For DC code control

Panel relay connector side			RS-232C device side	
1	GND	○	○	1 GND
2	TXD	○	○	2 TXD
3	RXD	○	○	3 RXD
			○	4 RTS
			○	5 CTS
6	DSR	○	○	6 DSR
20	DTR	○	○	20 DTR
7	GND	○	○	7 GND

For RS/CS code control

Panel relay connector side			RS-232C device side	
1	GND	○	○	1 GND
2	TXD	○	○	2 TXD
3	RXD	○	○	3 RXD
4	RTS	○	○	4 RTS
5	CTS	○	○	5 CTS
6	DSR	○	○	6 DSR
20	DTR	○	○	20 DTR
7	GND	○	○	7 GND

Recommended adaptive connector
Connector : HDBB-25PF(05)(Hirose Electric)
Case : HDB-CTF(Hirose Electric)

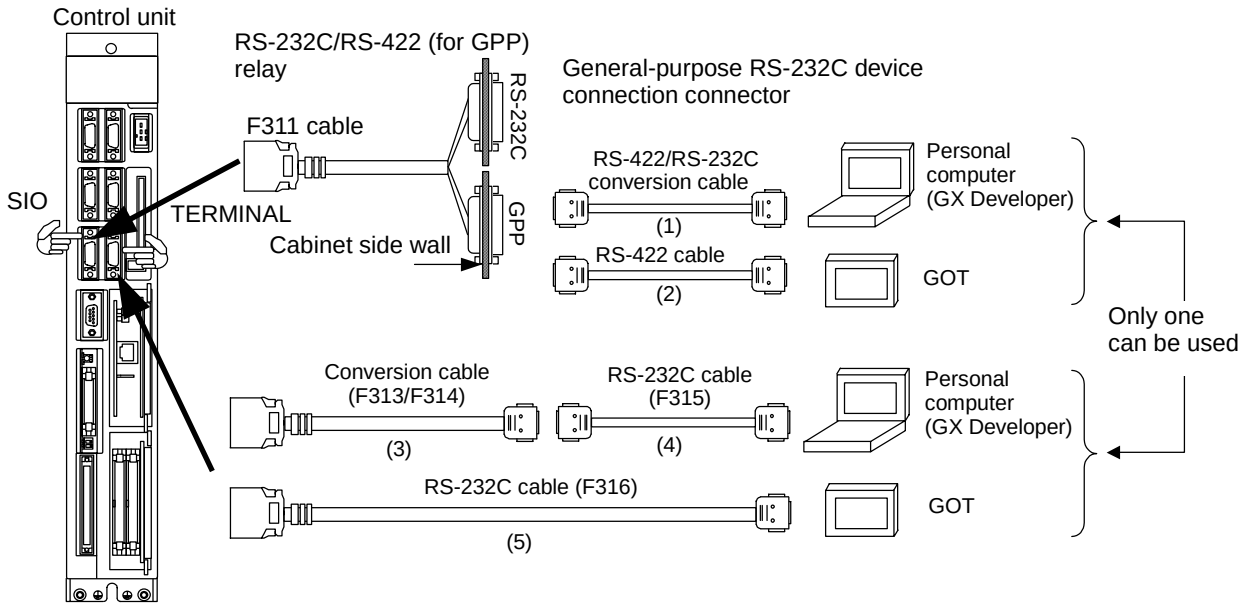
<Caution>
- Do not connect anything to the open pins.
- Keep the total cable length at 15m or less.

⚠ CAUTION

⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.
⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.
⚠ Separate the signal wire from the drive line/power line when wiring.

4.11 Connecting Other Peripheral Devices

When connecting the MELSEC PLC peripheral devices using the RS-422 interface, connect to the GPP connector side of the F311 relay cable connected to the SIO connector.
When connecting using the RS-232C interface, use the cables indicated below and connect to the connector terminal. In this case, the general-purpose RS-232C port can be used together.



Cable specifications are as described below.

(1) RS-422/RS-232C Conversion cable
DAFXIH-CABV (Diatrend Corp.), SC-09 (MEAU)

(2) RS-422 cable
Cable for GOT (MELSEC) AC30R4-25P (3.0m), AC100R4-25P (10.0m), AC300R4-25P (30.0m)

(3) Conversion cable (F313/F314)
(a) F313 (For personal computer)

NC side (TERMINAL) (20pin half-pitch)		Cable connection & Signal direction	PC side (25pin D-SUB)	
Signal	Pin No.		Pin No.	Signal
TXD	6	◄——►	2	TXD
RXD	16	◄——►	3	RXD
DTR	18	◄——►	20	DTR
GND	1	◄——►	7	GND

[NC side connector (Recommended)]
Connector : 10120-3000VE (Sumitomo 3M)
Case : 10320-52F0-008 (Sumitomo 3M)

[PC side connector (Recommended)]
Connector : HDBB-25S (Hirose Electric)
Case : HDB-CTF (Hirose Electric)

(b) F314 (For personal computer/communication terminal)

NC side (TERMINAL) (20pin half-pitch)		Cable connection & Signal direction	PC side (25pin D-SUB)	
Signal	Pin No.		Pin No.	Signal
TXD	6	⟷	2	TXD
RXD	16	⟷	3	RXD
DTR	18	⟷	20	DTR
GND	1	⟷	7	GND
			Communication terminal side (25pin D-SUB)	
TXD	2	⟷	2	TXD
TXD*	12	⟷	12	TXD*
RXD	4	⟷	4	RXD
RXD*	14	⟷	14	RXD*
ENCT*	8	⟷	8	ENCT*
GND	11	⟷	11	GND
GND	5	⟷	5	GND
GND	15	⟷	15	GND

[NC side connector (Recommended)]
Connector : 10120-3000VE (Sumitomo 3M)
Case : 10320-52F0-008 (Sumitomo 3M)

[PC side connector (Recommended)]
Connector : HDBB-25S (Hirose Electric)
Case : HDB-CTF (Hirose Electric)

[Communication terminal side connector (Recommended)]
Connector : 10120-3000VE (Sumitomo 3M)
Case : 10320-52F0-008 (Sumitomo 3M)

(4) RS-232C cable (F315)

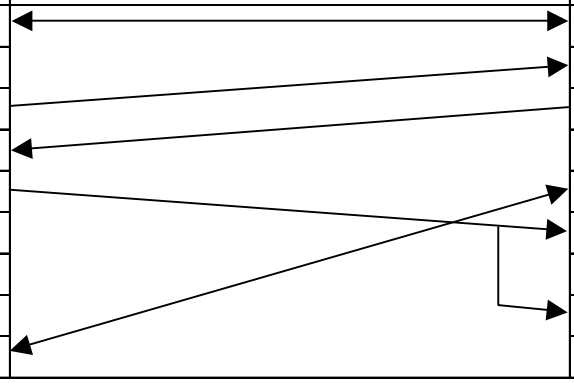
NC side (TERMINAL) (25pin D-SUB)		Cable connection & Signal direction	PC side (9pin D-SUB)	
Signal	Pin No.		Pin No.	Signal
GND	1	⟷	1	GND
		⟶	2	RD
SD	2	⟶	3	SD
RD	3	⟵	4	—
ER(DTR)	20	⟶	5	GND
		⟶	6	DR(DSR)
			7	—
		⟶	8	CS(CTS)
GND	7	⟵	9	—

[NC side connector (Recommended)]
Connector : HDBB-25S (Hirose Electric)
Case : HDB-CTF (Hirose Electric)

[PC side connector (Recommended)]
The recommended connector on the PC side is as indicated below. The connector on the partner side has to be matched with this connector.
9pinD-sub (Male) Inch screw fixing type (DDK)
17LE-23090-27(D3CC)

(5) RS-232C cable (F316)

MELDAS C6/C64 side (20pin half-pitch)		Cable connection & Signal direction	GOT side (9pin D-SUB)	
Signal	Pin No.		Pin No.	Signal
GND	1		1	CD
			2	RD(RXD)
SD	6		3	SD(TXD)
RD	16		4	DTR(ER)
ER(DTR)	18		5	SG(GND)
			6	DSR(DR)
			7	RS(RTS)
			8	CS(CTS)
GND	11		9	—



[NC side connector (Recommended)]
Connector : 10120-3000VE (Sumitomo 3M)
Case : 10320-52F0-008 (Sumitomo 3M)

[GOT side connector (Recommended)]
The recommended connector on the GOT side is as indicated below. The connector on the partner side has to be matched with this connector.
9pin D-sub (Male) Inch screw fixing type (DDK)
17LE-23090-27(D3CC)

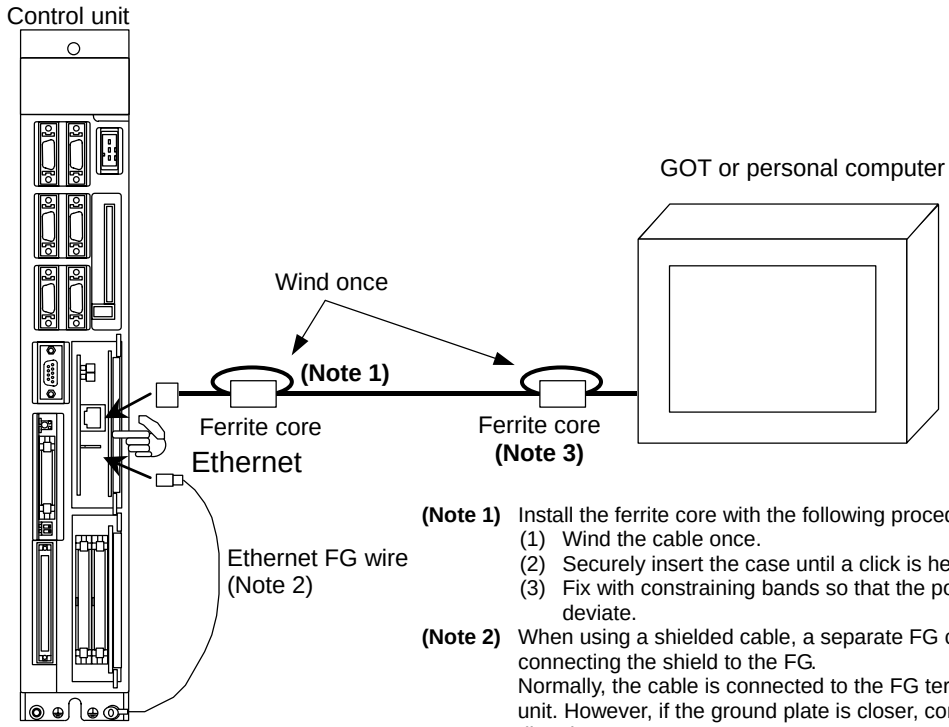
(Note 1) The conversion cable is not available from Mitsubishi.
(Note 2) Do not connect anything to the open pins.
(Note 3) Keep the total length of the cable to 15m or less.
(Note 4) For details on GOT, refer to “GOT-A900 Series User’s Manual (GT Works2 Version1/GT Designer2 Version1 compatible Connection System Manual)” and other relevant materials.

⚠ CAUTION

Incorrect connections could cause device damage, so always connect the cables to the designated connectors.
Do not connect or disconnect the connection cable between each unit while the power is ON.
⚠ Separate the signal wire from the drive line/power line when wiring.

4.12 Connecting the Display Unit with Ethernet

To connect the display unit with Ethernet, the Ethernet card (FCU6-EX875) must be mounted to the extension slot EXT2 on the control unit.
Connect the Ethernet cable to the modular jack on the Ethernet card.
As the Ethernet cable is easily affected by noise, separate the drive line and power line, and install the enclosed ferrite core on the control unit side.
When using in an adverse environment, or when compliance to EMC Directives is required, use a shielded cable.
Refer to the instruction manual for the display to be connected for details on other precautions.

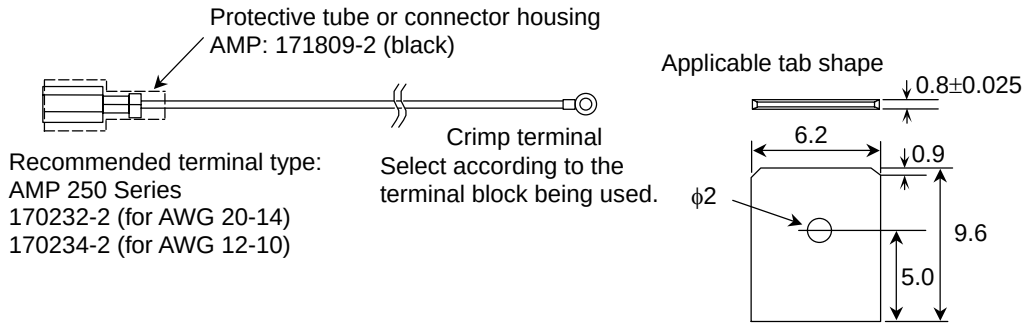


(Note 1) Install the ferrite core with the following procedure.
(1) Wind the cable once.
(2) Securely insert the case until a click is heard.
(3) Fix with constraining bands so that the position does not deviate.

(Note 2) When using a shielded cable, a separate FG cable is required for connecting the shield to the FG.
Normally, the cable is connected to the FG terminal on the control unit. However, if the ground plate is closer, connect the cable directly.

(Note 3) To comply with the EMC Directives, a ferrite core may also need to be installed on the display side.

FG cable assembly diagram



⚠ CAUTION

⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.

⃠ Do not connect or disconnect the connection cable between each unit while the power is ON.

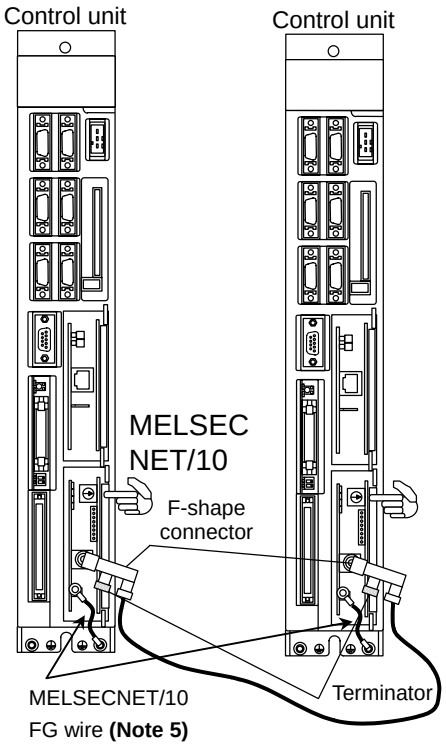
⚠ Separate the signal wire from the drive line/power line when wiring.

4.13 Connecting the Network with MELSECNET/10

The coaxial bus type and optical loop type networks can be used between the controllers in the MELSECNET/10 data link system. When using the coaxial bus type, the FCU6-EX878 MELSECNET/10 unit must be mounted in the control unit's extension slot, and when using the optical loop type, the FCU6-EX879 MELSECNET/10 unit must be mounted.
This unit functions as the control station and normal station of the MELSECNET/10 data link system. Refer to the AJ71QLP21 (S1)/AJ71QBR11 type MELSECNET/10 Network Unit User's Manual (Hardware Section) for details on MELSECNET/10.

(1) Connecting the coaxial bus type MELSECNET/10

Connect a dedicated coaxial cable to the MELSECNET/10 unit (FCU6-EX878) connector.
Use the enclosed F-shape connector, and always install the terminator A6RCON (optional) on the final unit.



(Note 1) Use a high-frequency coaxial cable 3C-2V or 5C-2V (compliant with JIS-C-3501).
The BNC-P-□-Ni-CAU (DDK) is recommended.

(Note 2) Lay the coaxial cable at least 100mm away from the other drive lines and control cables.
When using in an adverse environment, or when compliance to EMC Directives is required, use a double shielded coaxial cable (Mitsubishi Wire 5C-2V-CCY, etc.). Connect the outer shield to the FG using the shield clamp fitting.

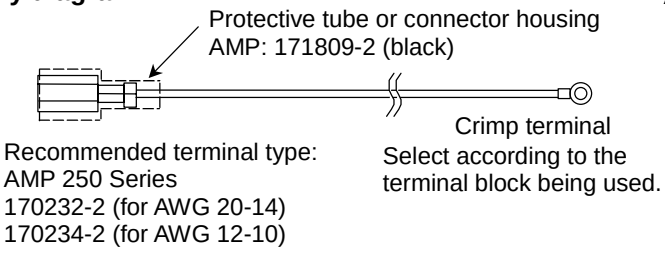
(Note 3) Use the following length of coaxial cable according to the total number of stations.

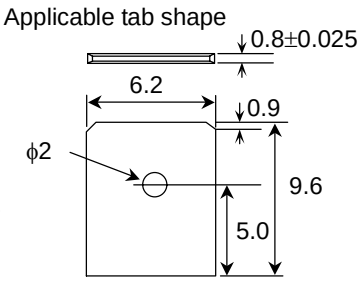
Total number of stations	Distance between stations
1 to 9 stations	1 to 500m
10 to 32 stations	1 to 5m 13 to 17m 25 to 500m

(Note 4) The BNC-TMP-05 (75) (Hirose Electric) terminator can be used instead of the A6RCON-R75 (optional).

(Note 5) Connect the FG wire from the FG terminal on the front of the MELSECNET/10 unit (FCU6-EX878) to the FG terminal on the bottom of the control unit.

FG cable assembly diagram



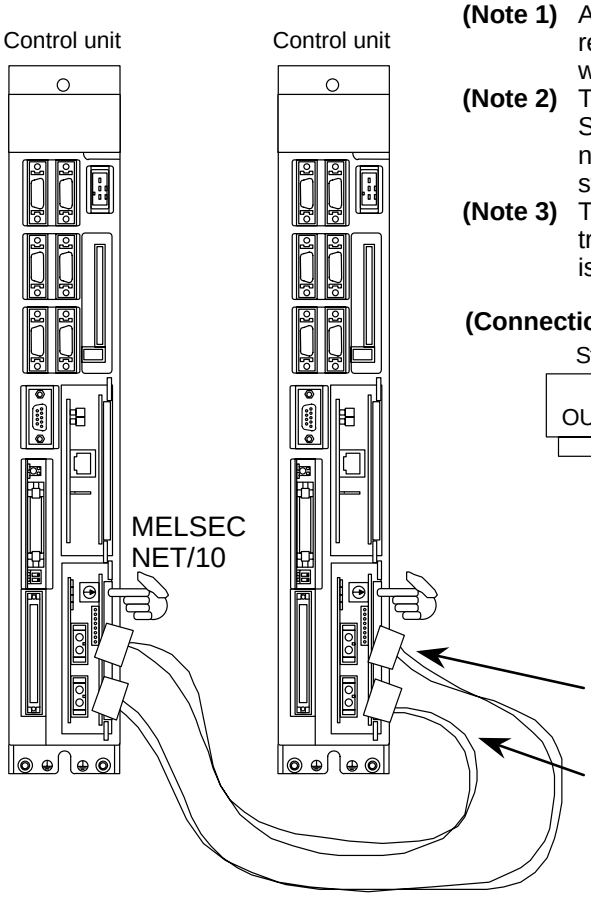


⚠ CAUTION

- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.**
- **⚠ Separate the signal wire from the drive line/power line when wiring.**

(2) Connecting the optical loop type MELSECNET/10

Connect a dedicated optical fiber cable to the optical connector on the MELSECNET/10 unit (FCU6-EX879).

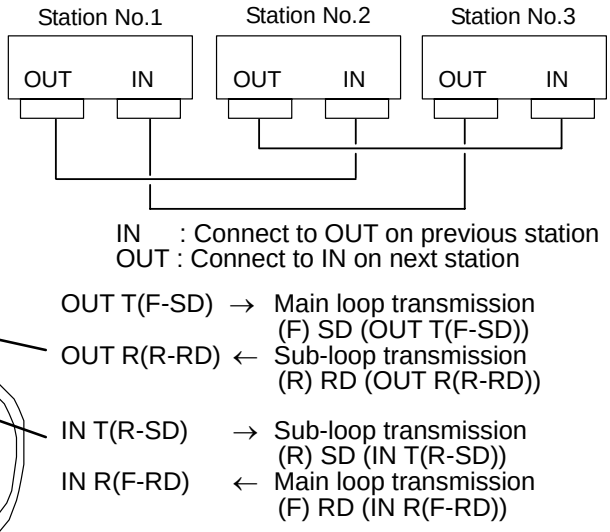


(Note 1) An indoor standard cable AS-2P-5M-A, etc., is recommended for the optical fiber cable. Consult with Mitsubishi Electric System Service.

(Note 2) The optical loop system's optical module follows SI specifications. The total distance within one network is 30km, and the distance between stations is 500m.

(Note 3) The optical loop system is a double loop transmission path method. The following system is used to connect the optical fiber cables.

(Connection example)



⚠ CAUTION

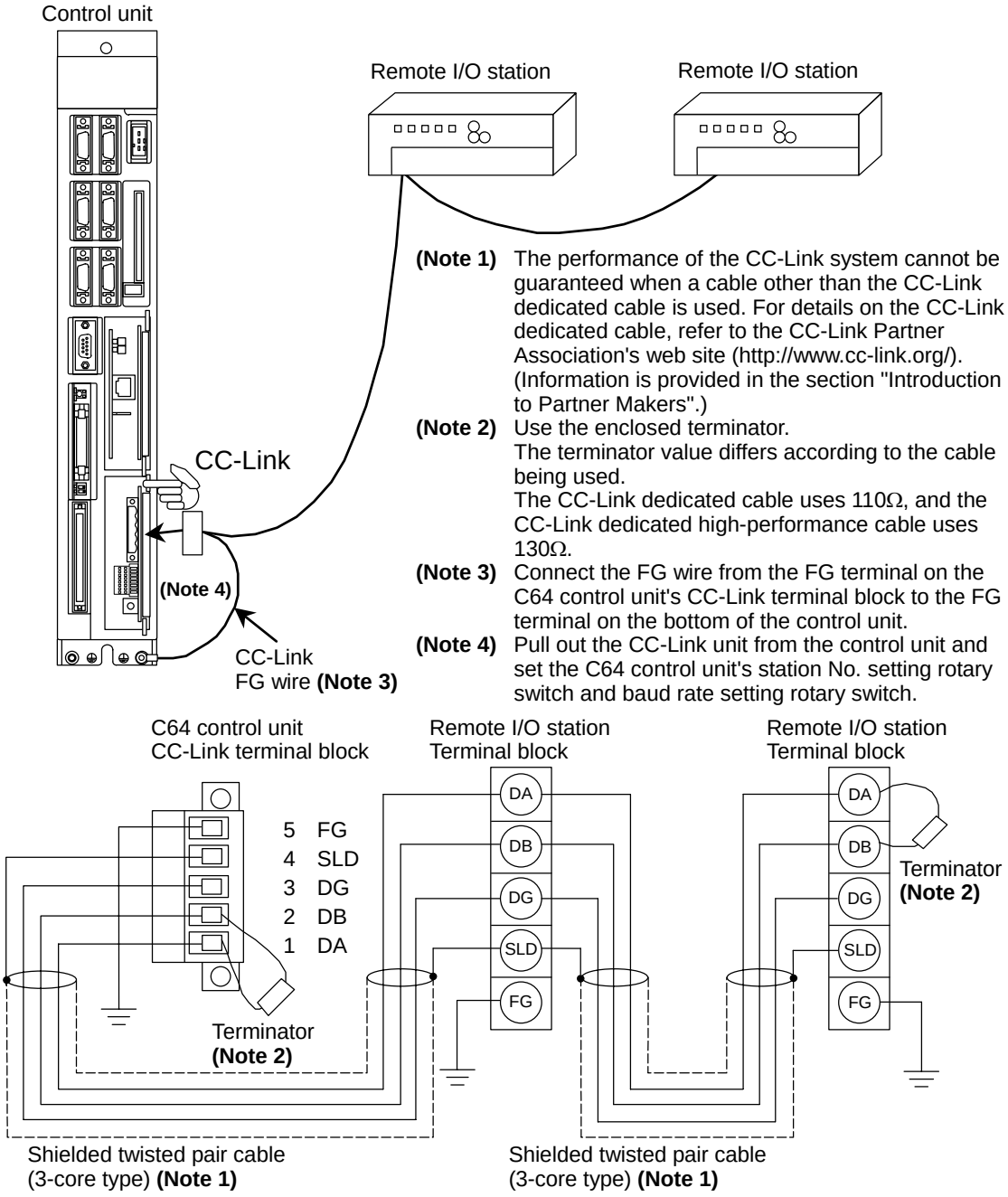
⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.

⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.

⚠ Separate the signal wire from the drive line/power line when wiring.

4.14 Connecting the IO Device with CC-Link

The CC-Link unit (FCU6-HR865) must be mounted in the control unit's extension slot to connect IO devices using CC-Link.
Connect a dedicated CC-Link cable to the CC-Link unit (FCU6-HR865) terminal block.
Always install the enclosed terminator on the final station.
This unit functions as the CC-Link system's master and local station. Refer to the MELSEC A1SJ61QBT11 type CC-Link System Master/Local Unit's User Manual, etc., for details on the CC-Link system.



(Note 1) The performance of the CC-Link system cannot be guaranteed when a cable other than the CC-Link dedicated cable is used. For details on the CC-Link dedicated cable, refer to the CC-Link Partner Association's web site (http://www.cc-link.org/). (Information is provided in the section "Introduction to Partner Makers".)

(Note 2) Use the enclosed terminator.
The terminator value differs according to the cable being used.
The CC-Link dedicated cable uses 110Ω, and the CC-Link dedicated high-performance cable uses 130Ω.

(Note 3) Connect the FG wire from the FG terminal on the C64 control unit's CC-Link terminal block to the FG terminal on the bottom of the control unit.

(Note 4) Pull out the CC-Link unit from the control unit and set the C64 control unit's station No. setting rotary switch and baud rate setting rotary switch.

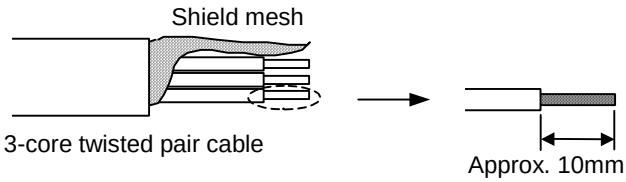
⚠ CAUTION

- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⊘ Do not connect or disconnect the connection cable between each unit while the power is ON.**
- **⚠ Separate the signal wire from the drive line/power line when wiring.**

Wiring the CC-Link terminal block

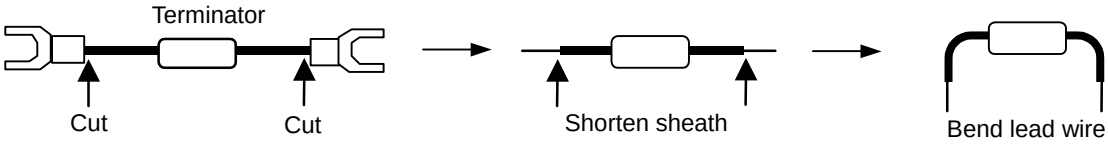
(1) Peel the cable's sheath, and separate the inner wire from the shield mesh.

(2) Peel the shield mesh and the inner wire's sheath, and twist the core wires.

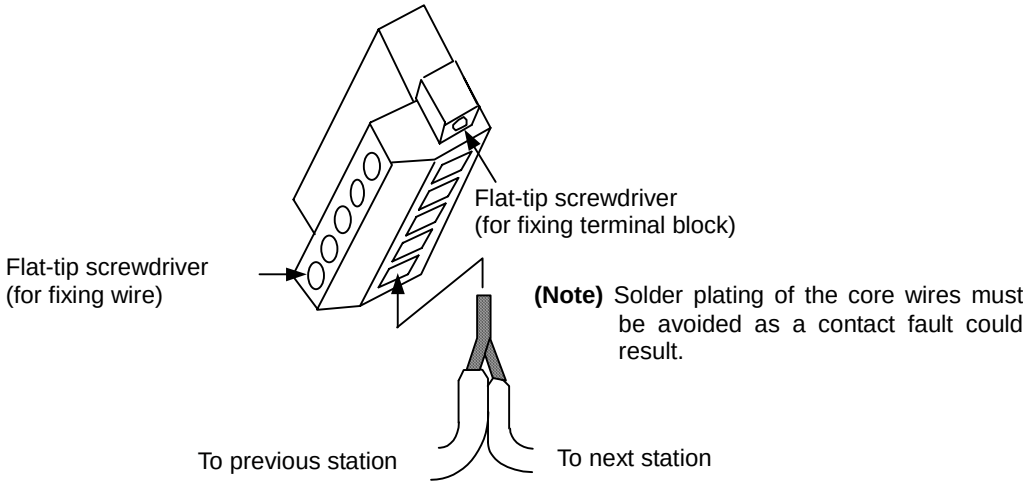


(3) Twist together one of the wires in the cables or the shield meshes of the cable to be connected to the previous station or next station.

(4) For the final station, treat the enclosed terminator as shown below, and then install.



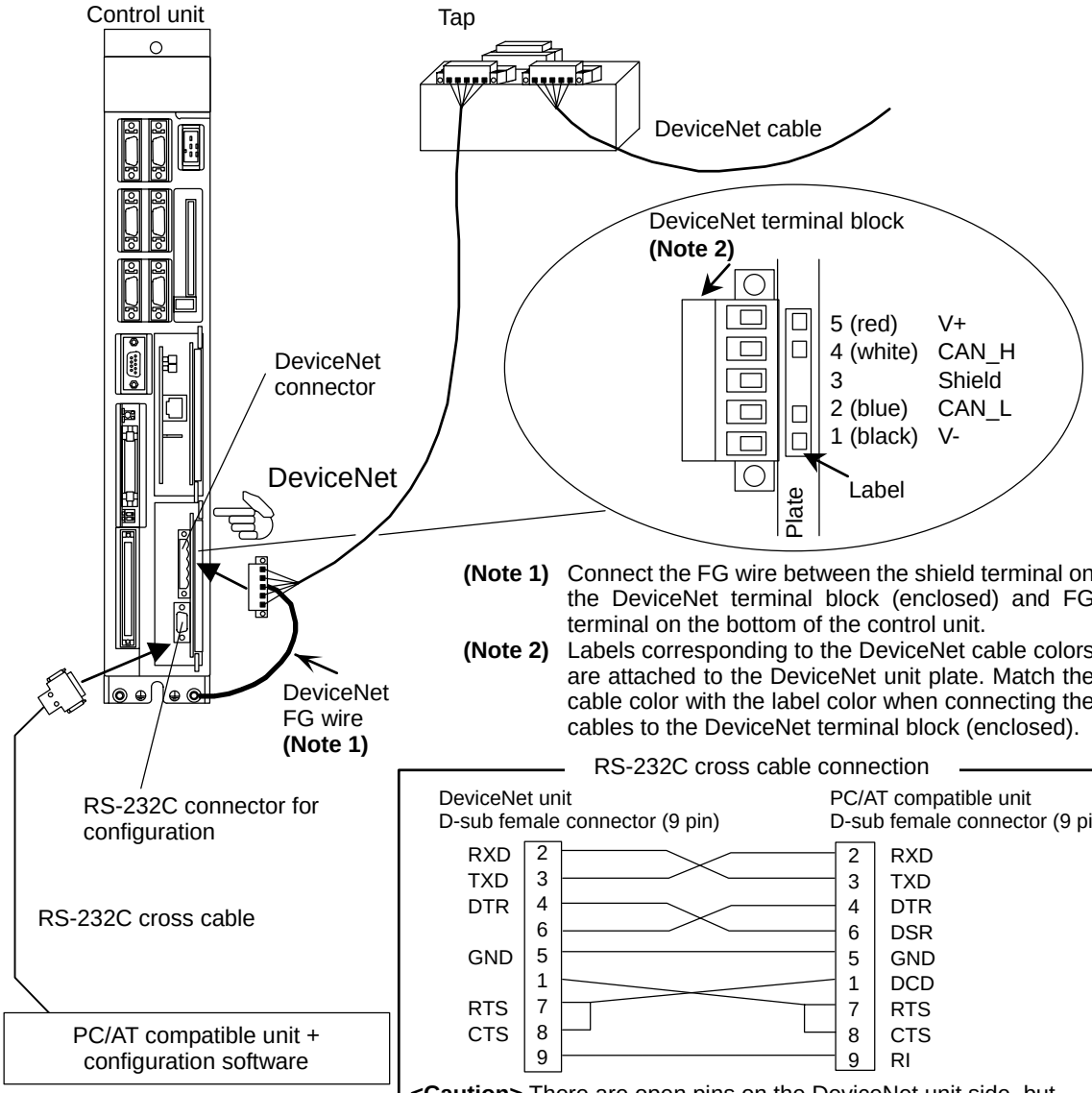
(5) Insert the wire's core wire into an opening on the terminal block, and tighten with a flat-tip screwdriver so that the wire does not dislocate.
Make sure that the terminal screw is sufficiently loosened before inserting the wire into the opening.



(6) After wiring to the terminal block, fit the terminal block into the CC-Link connector and fix it with a flat-tip screwdriver.

4.15 Connecting the IO Device with DeviceNet

The DeviceNet unit (FCU6-EX871-40) must be mounted in the control unit's extension slot to connect IO devices with DeviceNet.
Connect the dedicated DeviceNet cable to the DeviceNet unit's terminal block (enclosed).
When setting the parameters in the DeviceNet unit using the configuration software (parameter setting tool), connect an RS-232C cross cable between the DeviceNet unit and personal computer (PC/AT compatible unit). The configuration software must be installed in the personal computer at this time.
This unit functions as the DeviceNet master station. Refer to the DeviceNet Specifications (Release 2.0) issued by ODVA (Open DeviceNet Vendor Association) for details on the DeviceNet system.



(Note 1) Connect the FG wire between the shield terminal on the DeviceNet terminal block (enclosed) and FG terminal on the bottom of the control unit.

(Note 2) Labels corresponding to the DeviceNet cable colors are attached to the DeviceNet unit plate. Match the cable color with the label color when connecting the cables to the DeviceNet terminal block (enclosed).

RS-232C cross cable connection

DeviceNet unit D-sub female connector (9 pin)		PC/AT compatible unit D-sub female connector (9 pin)	
RXD	2	2	RXD
TXD	3	3	TXD
DTR	4	4	DTR
	6	6	DSR
GND	5	5	GND
	1	1	DCD
RTS	7	7	RTS
CTS	8	8	CTS
	9	9	RI

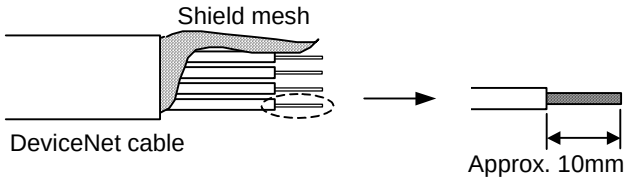
<Caution> There are open pins on the DeviceNet unit side, but connections should be made to all pins to eliminate the cable orientation.

⚠ CAUTION

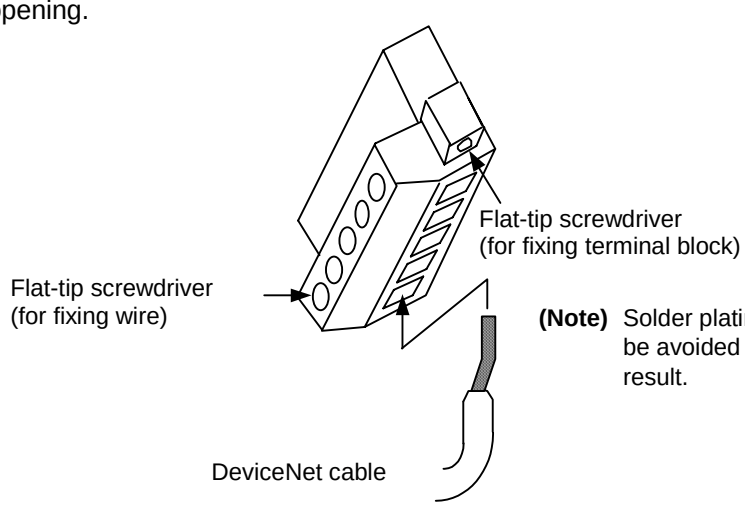
- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⃠ Do not connect or disconnect the connection cable between each unit while the power is ON.**
- **⚠ Separate the signal wire from the drive line/power line when wiring.**

Wiring the DeviceNet terminal block

(1) Peel the cable's sheath, and separate the inner wire from the shield mesh.
(2) Peel the shield mesh and the inner wire's sheath, and twist the core wires.



(3) Insert the wire's core wire into an opening on the terminal block, and tighten with a flat-tip screwdriver so that the wire does not dislocate.
Make sure that the terminal screw is sufficiently loosened before inserting the wire into the opening.



(Note) Solder plating of the core wires must be avoided as a contact fault could result.

(4) After wiring to the terminal block, fit the terminal block into the DeviceNet connector and fix it with a flat-tip screwdriver.

<Remarks>

Contact ODVA for details on the following devices required to structure the DeviceNet network.

- Network power supply unit
- Power supply tap
- Tap
- Terminator
- Cable

The ODVA contacts are listed below.

Open DeviceNet Vendor Association, Inc.
PMB 499
20423 State Road 7 #F6
Boca Raton, FL 33498-6797 USA
TEL: +1-954-340-5412 FAX: +1-954-340-5413

Contact the following company for details on the configuration software.

Hilscher Gesellschaft für Systemautomation mbH
Rheinstrasse 78
D-65795 Hattersheim Germany
TEL: +49-6190-9907-0 FAX: +49-6190-9907-50

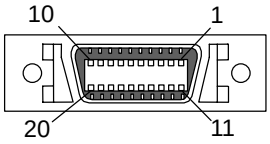
⚠ CAUTION

- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⃠ Do not connect or disconnect the connection cable between each unit while the power is ON.**
- **⚠ Separate the signal wire from the drive line/power line when wiring.**

4.16 Control Unit Connector Pin Assignments

Servo drive unit

SERVO1

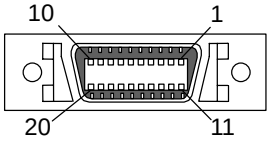


<Cable side connector type>
Plug : 10120-6000EL
Shell : 10320-3210-000
Recommended maker : Sumitomo 3M

1		GND	11		GND
2	O	SVTXD1	12	O	SVTXD1*
3	I	SVALM1	13	I	SVALM1*
4	I	SVRXD1	14	I	SVRXD1*
5		GND	15		GND
6			16		
7	O	SVEMG1	17	O	SVEMG1*
8			18		
9			19		
10			20		

Servo drive unit

SERVO2

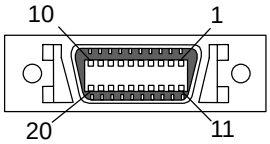


<Cable side connector type>
Plug : 10120-6000EL
Shel : 10320-3210-000
Recommended maker : Sumitomo 3M

1		GND	11		GND
2	O	SVTXD2	12	O	SVTXD2*
3	I	SVALM2	13	I	SVALM2*
4	I	SVRXD2	14	I	SVRXD2*
5		GND	15		GND
6			16		
7	O	SVEMG2	17	O	SVEMG2*
8			18		
9			19		
10			20		

Manual pulse generator

HANDLE

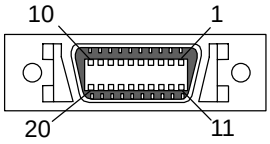


<Cable side connector type>
Plug : 10120-3000VE
Shell : 10320-52F0-008
Recommended maker : Sumitomo 3M

1		GND	11		GND
2			12		
3	I	2HA	13	I	2HB
4	I	1HA	14	I	1HB
5		GND	15		GND
6	O	+12V	16	O	+12V
7	I	3HA	17	I	3HB
8			18		
9			19		
10			20		

Synchronous feed encoder

ENC

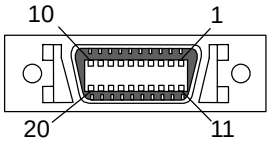


<Cable side connector type>
Plug : 10120-3000VE
Shell : 10320-52F0-008
Recommended maker : Sumitomo 3M

1		GND	11		GND
2	I	PC1	12	I	PC1*
3	I	PB1	13	I	PB1*
4	I	PA1	14	I	PA1*
5		GND	15		GND
6			16		
7	I	PC2	17	I	PC2*
8	I	PB2	18	I	PB2*
9	I	PA2	19	I	PA2*
10	O	+5V	20	O	+5V

Serial

SIO

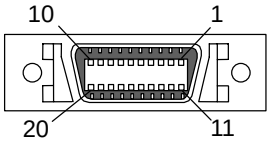


<Cable side connector type>
Plug : 10120-6000EL
Shell : 10320-3210-000
Recommended maker : Sumitomo 3M

1		GND	11		GND
2	I	RXD1	12	O	TXD1
3	I	CTS	13	O	RTS1
4	I	DSR1	14	O	DTR1
5		GND	15		GND
6	O	DTR2	16	O	DTR2*
7	O	TXD2	17	O	TXD2*
8	I	RXD2	18	I	RXD2*
9	I	DCD2	19	I	DCD2*
10	O	+5V	20	O	+5V

Communication terminal

TERMINAL

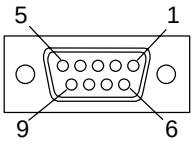


<Cable side connector type>
Plug : 10120-6000EL
Shell : 10320-3210-000
Recommended maker : Sumitomo 3M

1		GND	11		GND
2	O	TXD	12	O	TXD*
3			13		
4	I	RXD	14	I	RXD*
5		GND	15		GND
6	O	(TXD2)	16	I	(RXD2)
7			17		
8	I	ENCT*	18	O	(DTR2)
9			19		
10			20		

Skip

SKIP



1	I	SKIP 0	6	I	SKIP 0*
2	I	SKIP 1	7	I	SKIP 1*
3	I	SKIP 2	8	I	SKIP 2*
4	I	SKIP 3	9	I	SKIP 3*
5					

<Cable side connector type>
Connector : CDE-9PF
Contact : CD-PC-111
Case : HDE-CTH
Recommended maker : Hirose Electric

Machine input/output

DIO

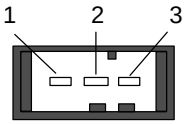
<Cable side connector type>
Connector : 7920-6500SC
Strain relief : 3448-7920
Recommended maker : Sumitomo 3M

		B			A
10	I	X0	10	I	X8
9	I	X1	9	I	X9
8	I	X2	8	I	XA
7	I	X3	7	I	XB
6	I	X4	6	I	XC
5	I	X5	5	I	XD
4	I	X6	4	I	XE
3	I	X7(EMG)	3	I	XF
2	I	COM	2	I	COM
1	O	SA	1		0V

Note) This differs depending on whether sink or source is used.
Supply the following voltage to the COM.
Sink : 24VDC
Source : GND

Remote I/O

RIO-M

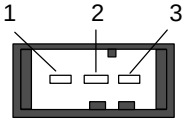


<Cable side connector type>
Connector : 1-178288-3
Contact : 1-175218-2
Recommended maker : Tyco Electronics AMP

1	I/O	TXRX1
2	I/O	TXRX1*
3		GND

Remote I/O

RIO-M/S

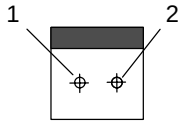


<Cable side connector type>
Connector : 1-178288-3
Contact : 1-175218-2
Recommended maker : Tyco Electronics AMP

1	I/O	TXRX2
2	I/O	TXRX2*
3		GND

Battery

BAT

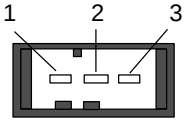


<Cable side connector type>
The connector and contact depend on the battery.

1		GND
2	I	+3.6V

+24V input

DC24VIN



<Cable side connector type>
Connector : 1-178288-3
Contact : 1-175218-5
Recommended maker : Tyco Electronics AMP

1	I	+24V
2		GND
3		FG

⚠ CAUTION

- **⚠ Do not apply a voltage other than that specified in this manual onto the connector. Failure to observe this could lead to rupture or damage.**
- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**

5. CONNECTION OF COMMUNICATION TERMINAL

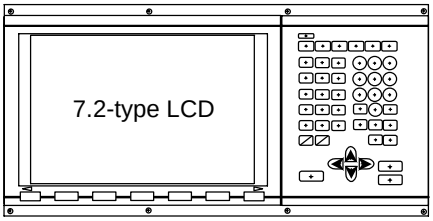
The communication terminal is described in this chapter.

5.1 Outline of Communication Terminal

The communication terminal is configured of the display and keyboard. The following types are available according to the display type, etc.

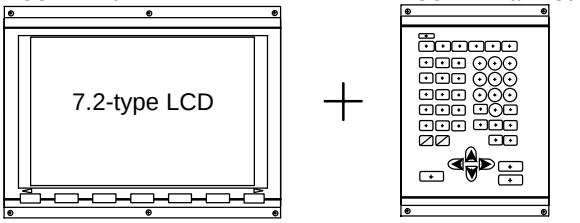
◊ 7.2-type monochrome LCD/integrated keyboard

FCUA-LD100



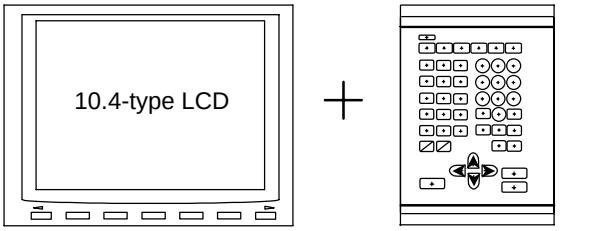
◊ 7.2-type monochrome LCD/Keyboard separated type

FCUA-LD10 FCUA-KB20/KB30



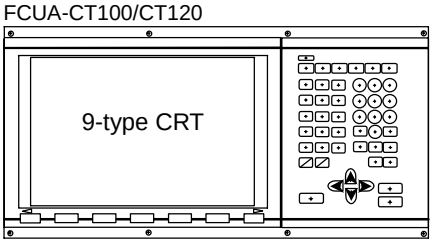
◊ 10.4-type monochrome LCD/Keyboard separated type

FCU6-DUT32 FCUA-KB021/KB031



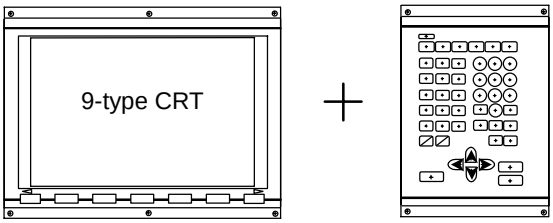
◊ 9-type CRT/Keyboard integrated type

FCUA-CT100/CT120



◊ 9-type CRT/Keyboard separated type

FCUA-CR10 FCUA-KB10



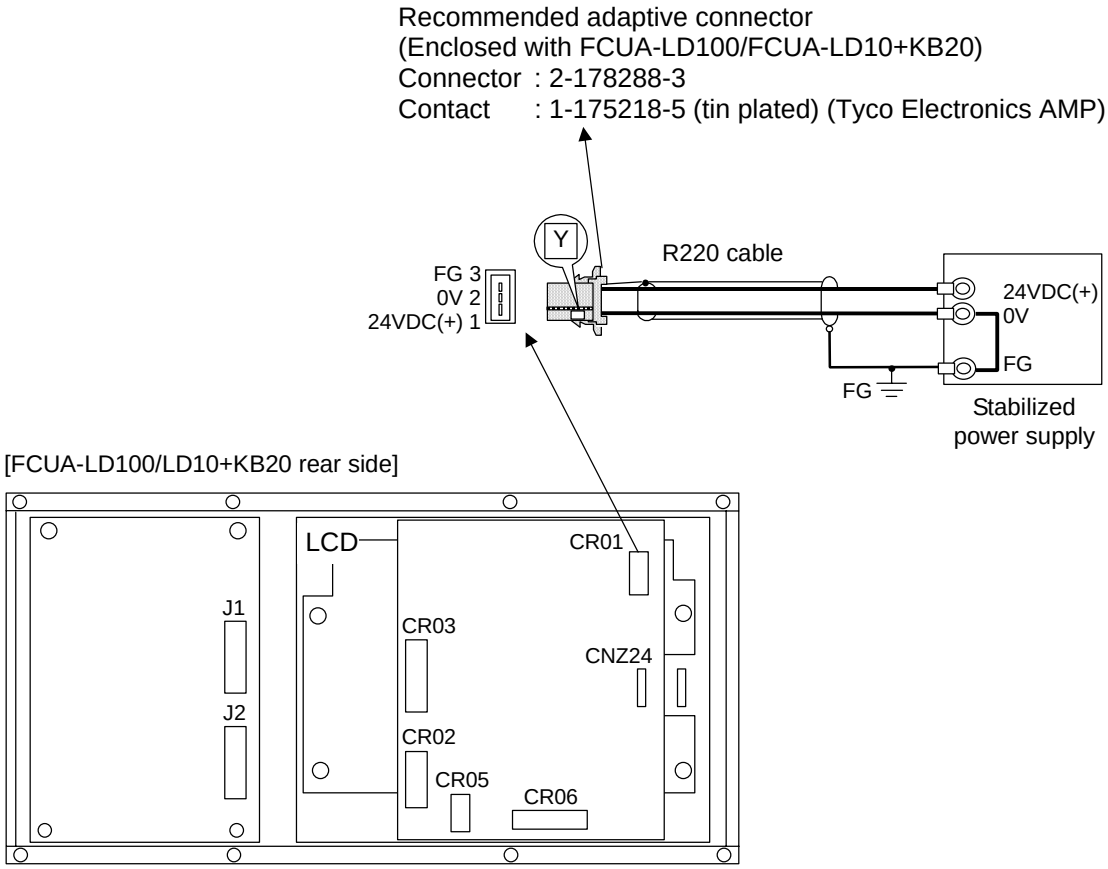
5.2 Connection of Power Supply

The 24VDC must be supplied to the communication terminal.
Prepare a stabilized power supply that satisfies the following conditions.
The 9-type CRT type requires 100VAC for the CRT power supply.

Type	FCUA-LD100/ LD10	FCU6-DUT32	FCUA-CT100/ CT120/KB10
Power voltage	24VDC±5% Ripple ±5% (p-p)		
Instantaneous power failure tolerable time	Follows specifications of 24VDC power supply being used		
Current consumption	24VDC, 0.9A	24VDC, 0.9A	24VDC, 0.6A

5.2.1 Connection of Power Supply to 7.2-type Monochrome LCD (FCUA-LD100/FCUA-LD10+KB20)

Supply 24VDC to the CR01 connector on the rear of the LCD.



⚠ CAUTION

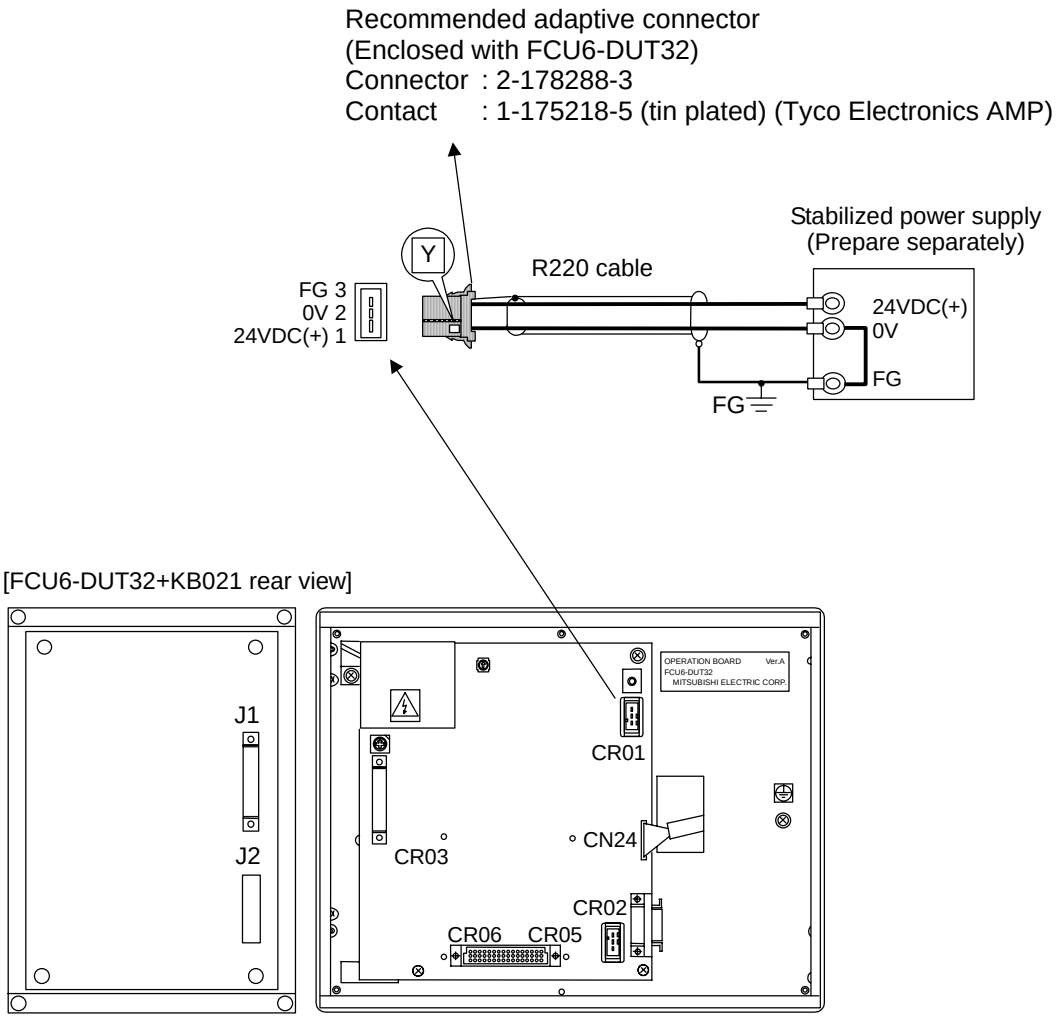
⚠ Separate the signal wire from the drive line/power line when wiring.

⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.

5.2.2 Connection of Power Supply to 10.4-type Monochrome LCD (FCU6-DUT32+KB021)

Supply 24VDC to the CR01 connector on the rear of the LCD.



⚠ CAUTION

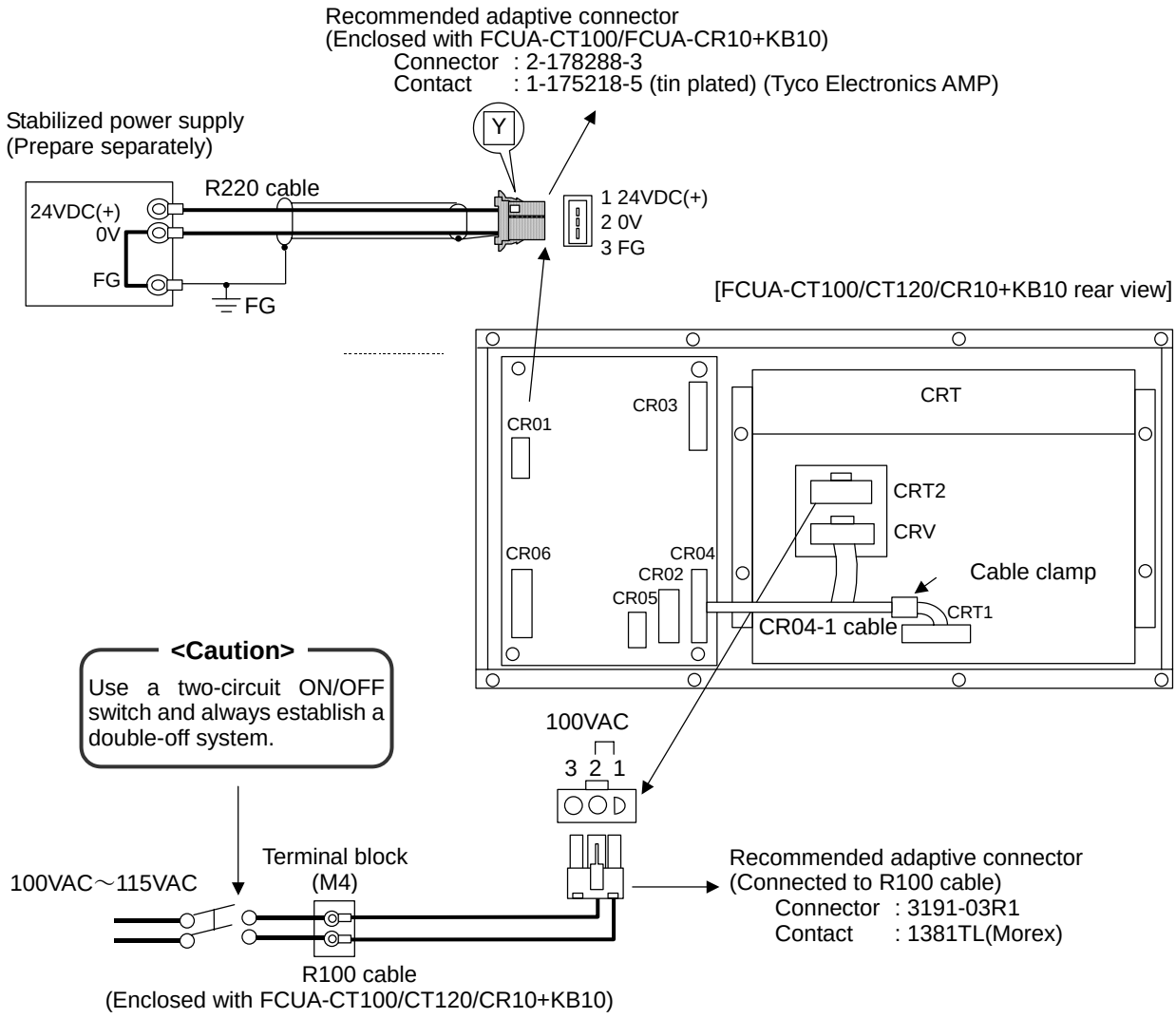
⚠ Separate the signal wire from the drive line/power line when wiring.

⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.

5.2.3 Connection of Power Supply to 9-type CRT (FCUA-CT100/FCUA-CR10+KB10)

Supply 100VAC to the connector CRT2 on the rear of the CRT, and 24VDC to the connector CR01 on the rear of the keyboard.



⚠ CAUTION

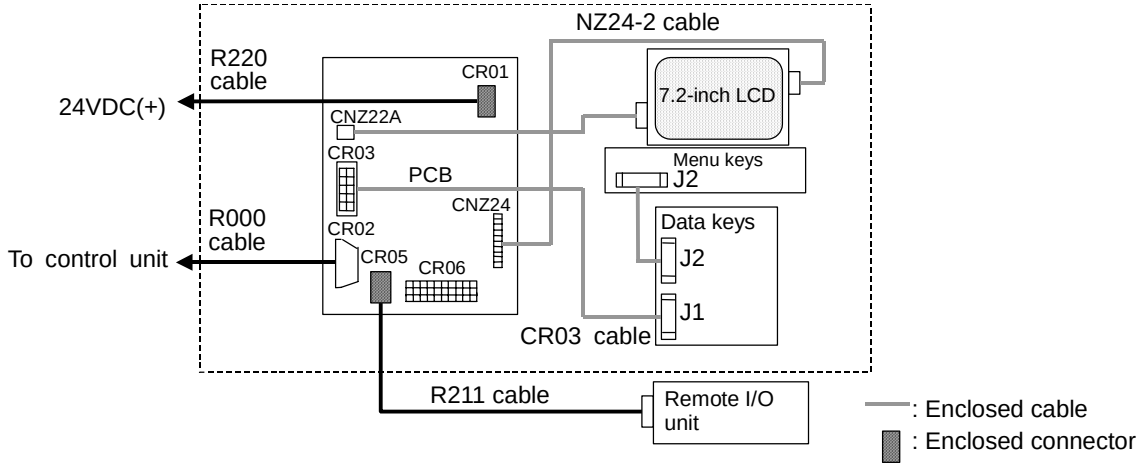
⚠ Separate the signal wire from the drive line/power line when wiring.

⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

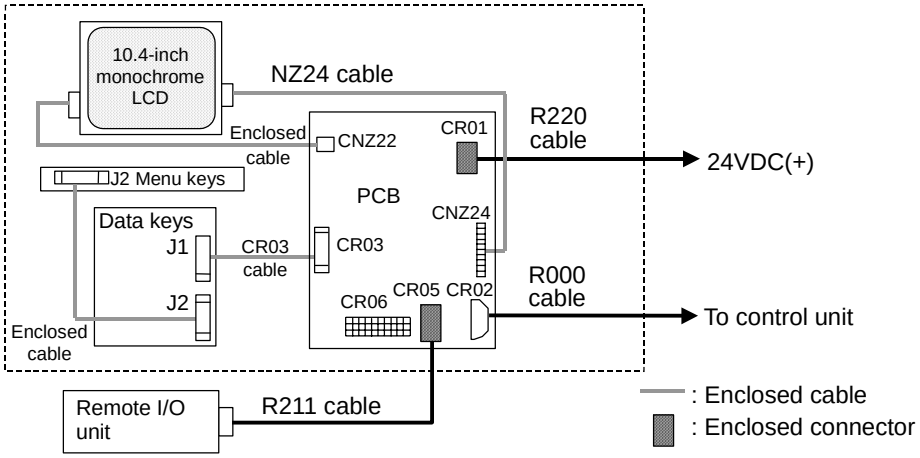
⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.

5.3 Internal Connections

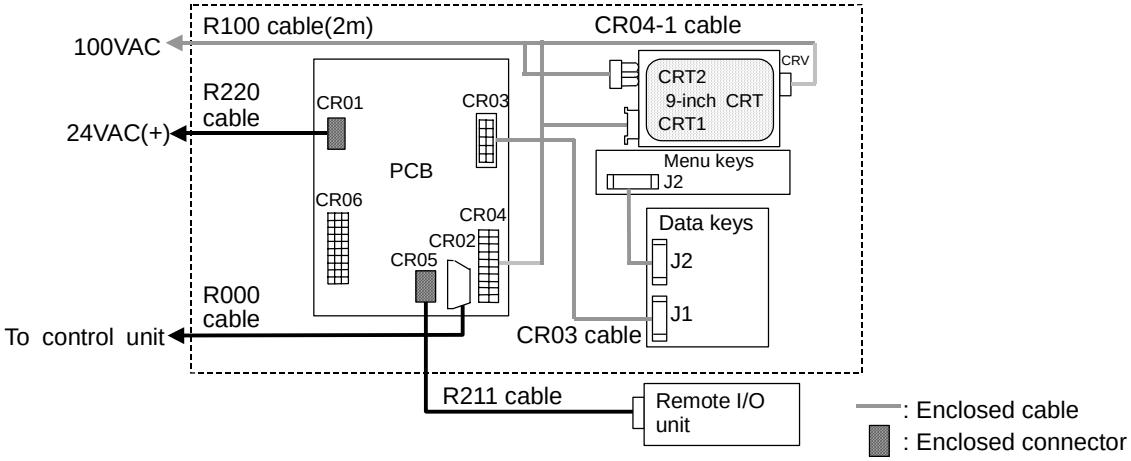
(1) Internal connection of 7.2-type monochrome LCD (FCUA-LD100/FCUA-LD10+KB20)



(2) Internal connection of 10.4-type monochrome LCD (FCU6-DUT32+KB021)

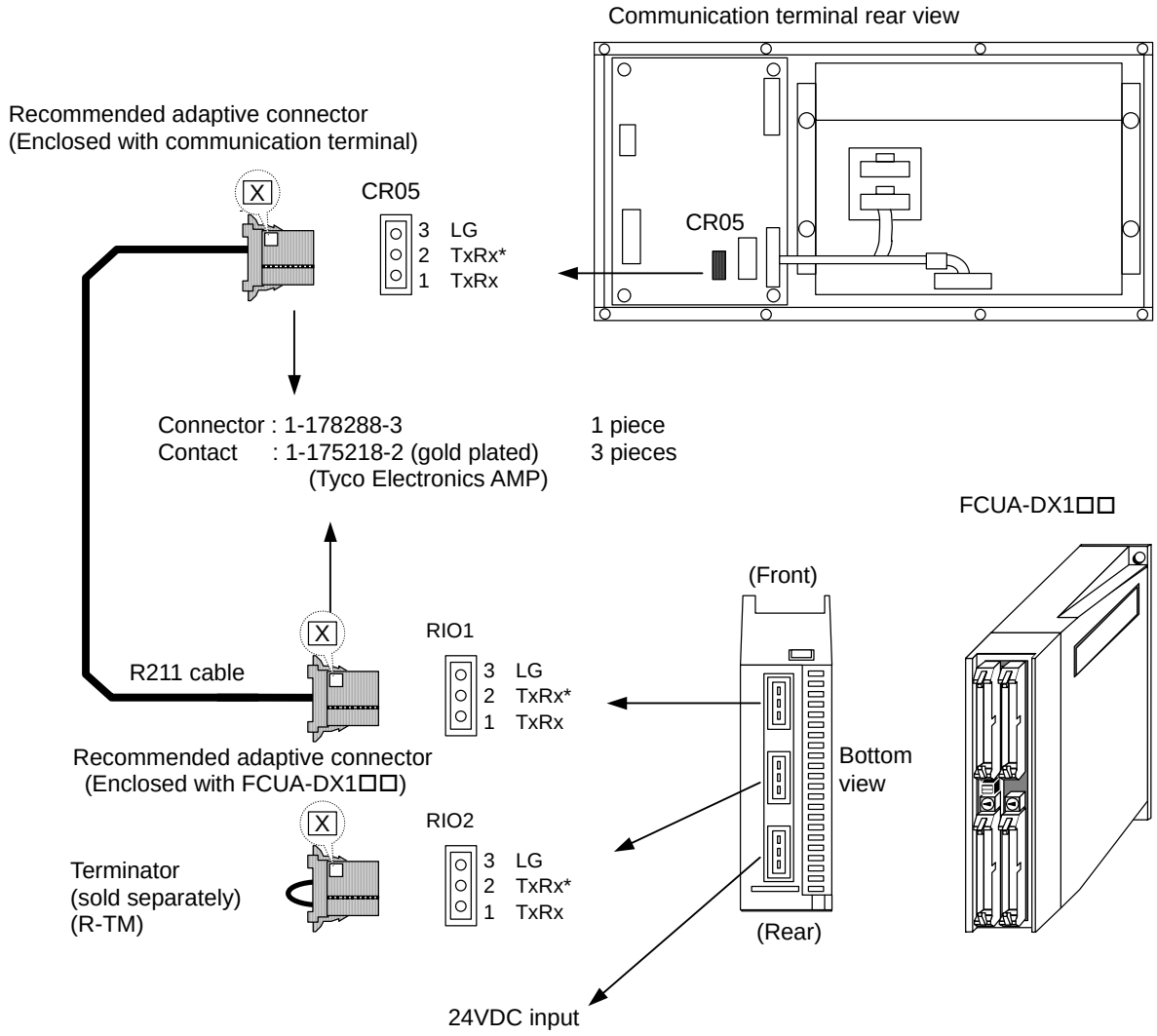


(3) Internal connection of 9-type CRT (FCUA-CT100/FCUA-CR10+KB10)



5.4 Connection of Remote I/O Unit

A maximum of two remote I/O units can be connected to the communication terminal. Manufacture the R211 cable (refer to cable manufacturing drawings for details) and connect it to the connector CR5 on the rear of the communication terminal as shown below.
Use the enclosed connectors and contacts. If the accessories are insufficient, use the CN211 connector set (optional, with one end).
The remote I/O unit serial link station No. setting method, etc., are the same as for when connecting to the control unit. However, the machine control input/output signal assignment addresses will differ. (Refer to "PLC Interface Manual" for details.)



<CAUTION>
The remote I/O unit requires a separate 24VDC(+) power supply.
Refer to section "6.4 Connection of remote I/O power supply".

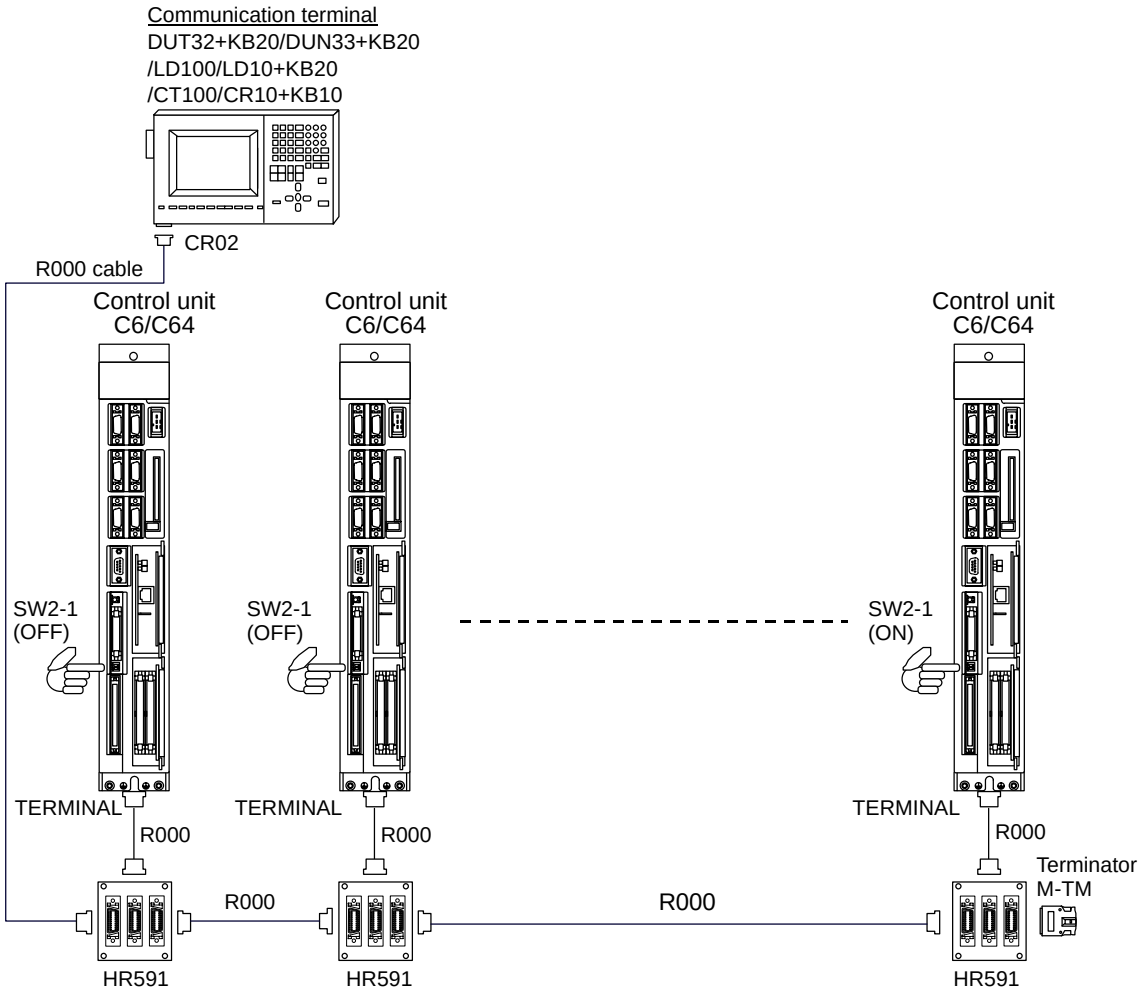
If there is a second remote I/O unit, connect the R211 cable from RIO2 connector to the second remote I/O unit's RIO1 connector. A terminator (R-TM) must be installed on the final station's remote I/O unit's RIO2.

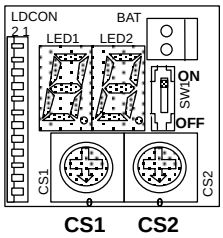
⚠ CAUTION

⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.

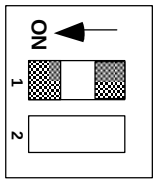
5.5 Example of Connecting Multiple Control Units to the Communication Terminal





SW1

CS1 **CS2**



SW2

Set SW2-1 to OFF except for the final station.

Set to ON for the final station.
The final station refers to the station with no subsequent slave stations.

When connecting multiple control units, the station No. of each control unit must be set.
To set the station No., set SW1 to ON, set the rotary switch CS1 to "D", set the station No. in CS2, and turn the power ON. After setting, return each switch to their original settings.
The same station No. cannot be set in duplicate for multiple control units.

(Note 1) Up to 16 control units can be connected.
(Note 2) The R000 cable has the same specifications (both connector and specifications) as the SH21 cable.
(Note 3) Install the terminator M-TM to the HR591 card for the control unit having the longest cable length from the communication terminal (LD100, etc.).
(Note 4) Set the control unit's slide switch SW2-1 to ON only for the final station.
(Note 5) The total length of the cable connected to each unit must be 30m or less.
The cable connected between the control unit and HR591 card must be 1m or less.
(Note 6) An R001 cable (distribution cable) can be used instead of the HR591 card.

⚠ CAUTION

⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.

6. CONNECTION OF REMOTE I/O UNIT

This chapter describes the connection between remote I/O unit and machine control signals.

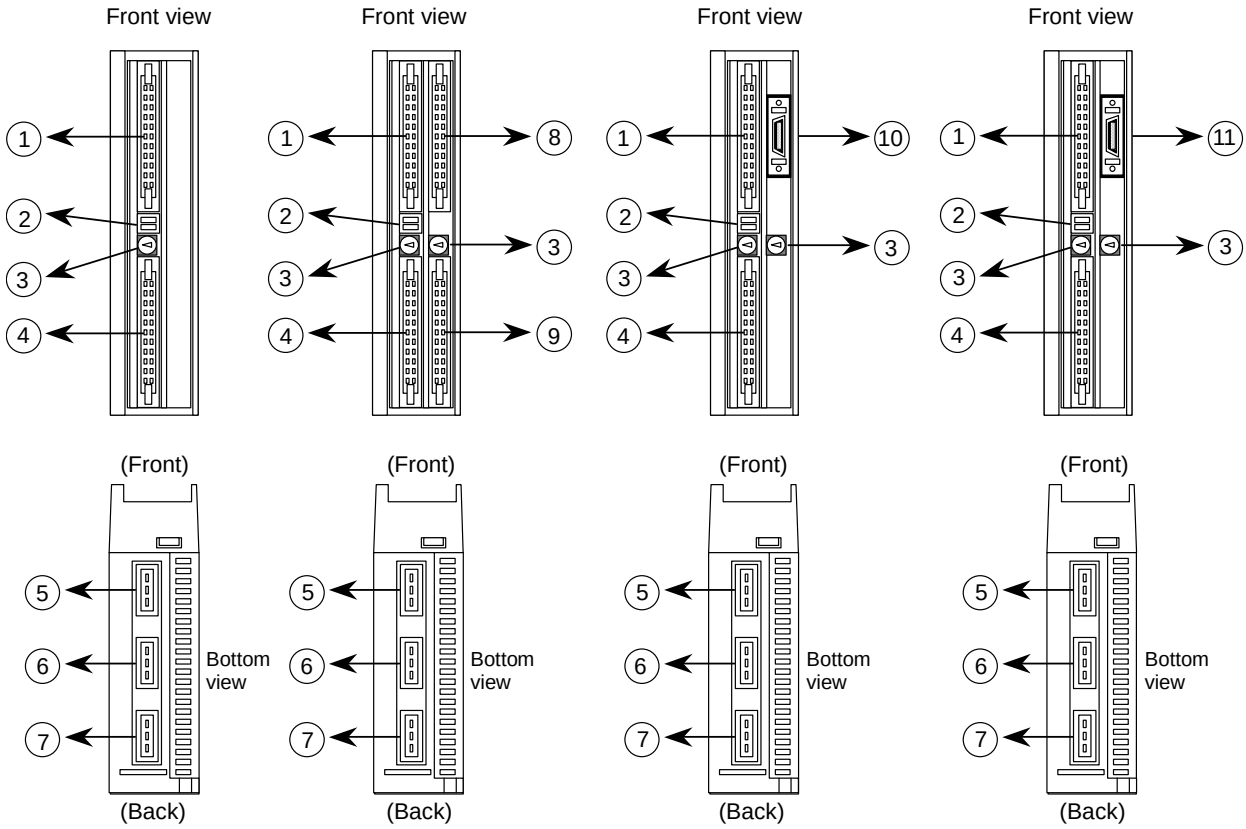
6.1 Outline of Remote I/O Unit

The following ten types of remote I/O units (FCUA-DX□□□) are available, depending on the type of input/output signal and No.of contacts. Use serial link connections (MC link B) to connect the unit with the control unit or the communication terminal.
When the remote I/O unit is connected with serial links, multiple units can be used as long as the total No. of occupied stations (channels) is within 8 stations. (Refer to Section 6.3 "Setting the Station No. When Using Multiple Remote I/O Units" for details.)

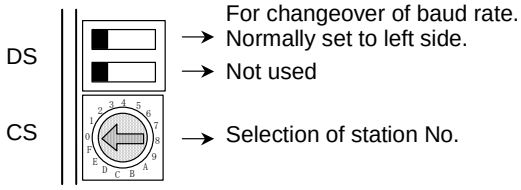
Unit name	Machine control signals that can be handled	No. of occupied serial link stations
FCUA-DX100	Digital input signal (DI) : 32 points (insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) sink type	1
FCUA-DX101	Digital input signal (DI) : 32 points (insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type	1
FCUA-DX110	Digital input signal (DI) : 64 points (insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) sink type	2
FCUA-DX111	Digital input signal (DI) : 64 points (insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) source type	2
FCUA-DX120	Digital input signal (DI) : 64 points (insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) sink type Analog output (AO) : 1 point	2
FCUA-DX121	Digital input signal (DI) : 64 points (insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) source type Analog output (AO) : 1 point	2
FCUA-DX130	Digital input signal (DI) : 32 points (insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) sink type Handle input : 2 points	2
FCUA-DX131	Digital input signal (DI) : 32 points (insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type Handle input : 2 points	2
FCUA-DX140	Digital input signal (DI) : 32 points (insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) sink type Analog input (AI) : 4 points Analog output (AO) : 1 point	2
FCUA-DX141	Digital input signal (DI) : 32 points (insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type Analog input (AI) : 4 points Analog output (AO) : 1 point	2

6.2 Names of Each Remote I/O Unit Section

FCUA-DX10□ **FCUA-DX11□/FCUA-DX12□** **FCUA-DX13□** **FCUA-DX14□**



① DI-L (machine input signal connector)
② DS (baud rate changeover switch)
③ CS (station No. changeover switch)
④ DO-L (machine output signal connector)
⑤ RIO1 (serial connection connector #1)
⑥ RIO2 (serial connection connector #2)
⑦ DCIN (24VDC(+) power input connector)
⑧ DI-R (machine input signal connector)
⑨ DO-R (machine output signal connector)
⑩ HANDLE (manual pulse generator signal input connector)
⑪ AIO (analog signal input/output connector)



Enlarged drawing of DS and CS

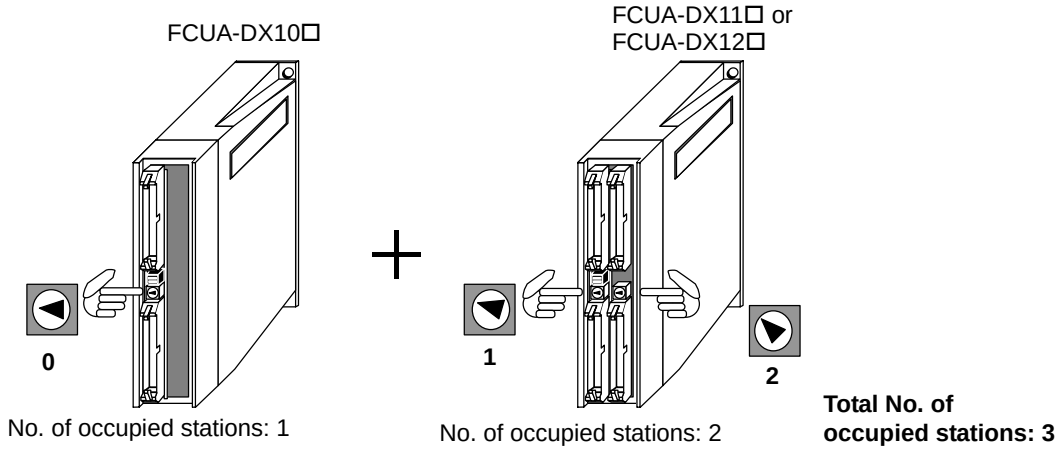
6.3 Setting the Station No. When Using Multiple Remote I/O Units

When the remote I/O unit is connected with serial links (MC link B), multiple units can be used as long as the total No. of occupied stations is within 8 stations.

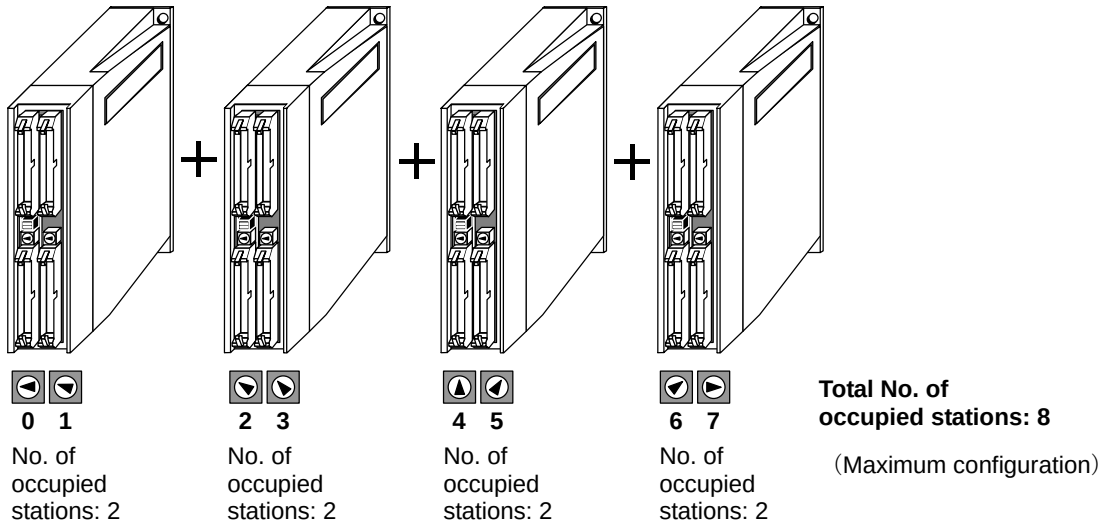
Unit name	No. of occupied serial link stations
FCUA-DX10 ☐	1
FCUA-DX11 ☐	2
FCUA-DX12 ☐	2
FCUA-DX13 ☐	2
FCUA-DX14 ☐	2

When using multiple remote I/O units, a characteristic station No. must be set for each unit. The FCUA-DX10 ☐ unit has one station No. setting switch, and FCUA-DX11☐, DX12☐, DX13 ☐ and DX14 ☐ units have two switches. Each of these switches must be set to a characteristic station No.

<Setting example 1>



<Setting example 2> FCUA-DX11☐ or FCUA-DX12☐ 4 units



<CAUTION>

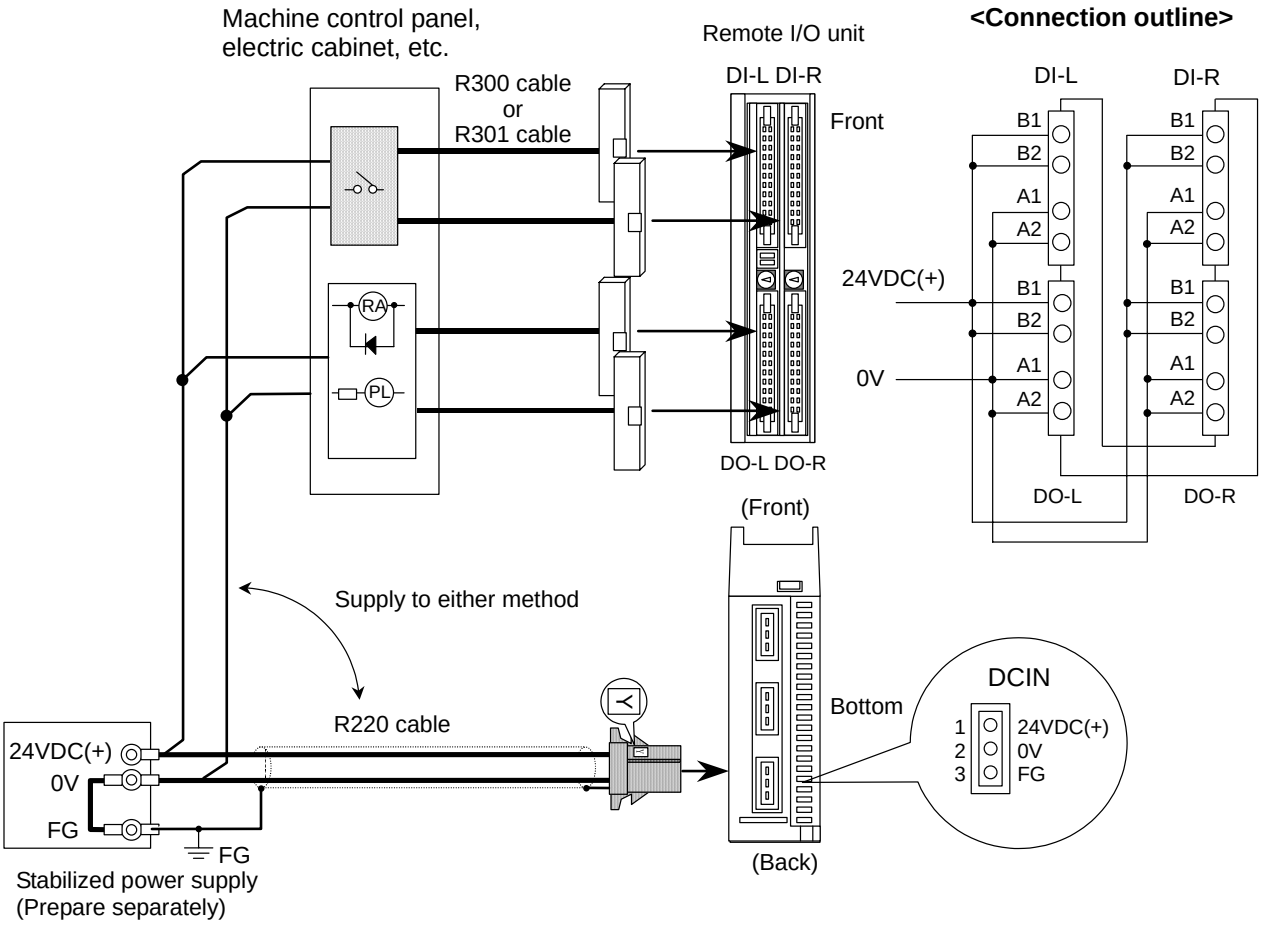
The assignment of each unit's input/output signal address will change with the setting of the station No.
Refer to "PLC Interface Manual" for details.

6.4 Connection of Remote I/O Power Supply

24VDC(+) is required to run the remote I/O unit. Prepare a stabilized power supply that satisfies the following conditions.

Output voltage	24VDC±5%	
Ripple	±5% (P-P)	
Max. output current	FCUA-DX10□	2.4A or more
	FCUA-DX11□	3.8A or more
	FCUA-DX12□	3.8A or more
	FCUA-DX13□	3.4A or more
	FCUA-DX14□	3.4A or more

The 24VDC(+) power for the control circuit is supplied from the DCIN connector on the bottom of the unit or from DI-L, DI-R, DO-L or DO-R connectors on the front. When supplying from the front connector, supply to all corresponding pins.
When manufacturing the R300 cable, use the CN300 one end connector (optional, with one end), and when manufacturing the R301 cable, use the CS301 connector set (optional, with both ends).



⚠ CAUTION

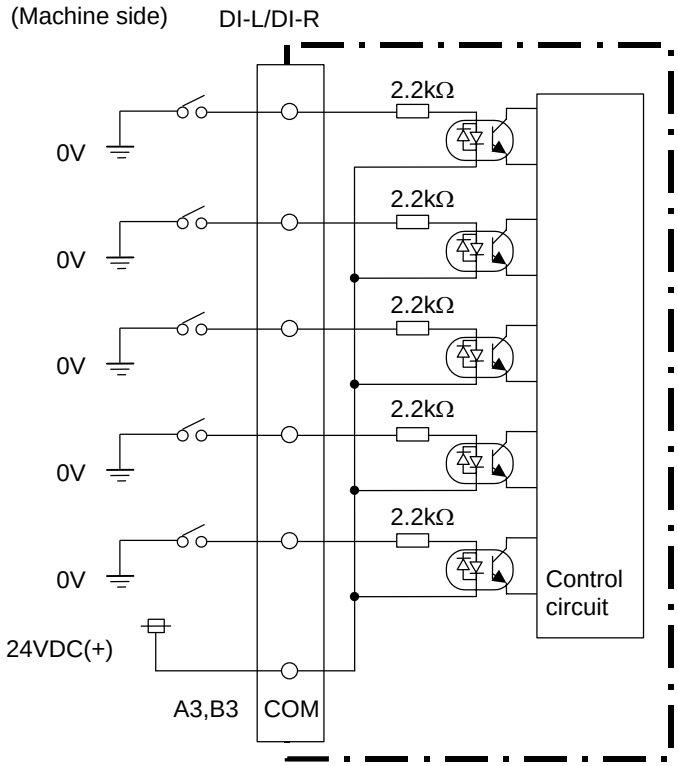
⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

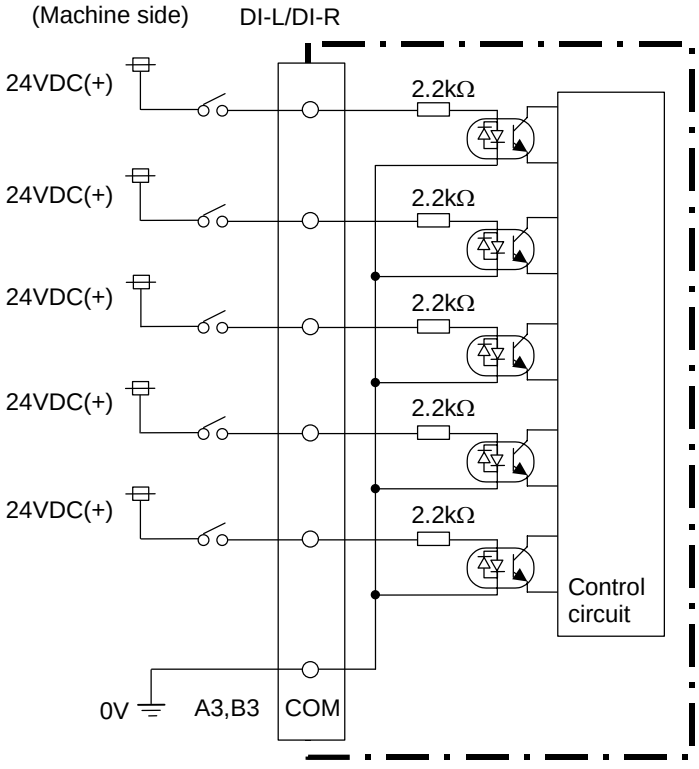
6.5 Outline of Digital Signal Input Circuit

The digital signal input circuit can be selected from sink type or source type in card units.

Input circuit



Sink type



Source type

Input conditions

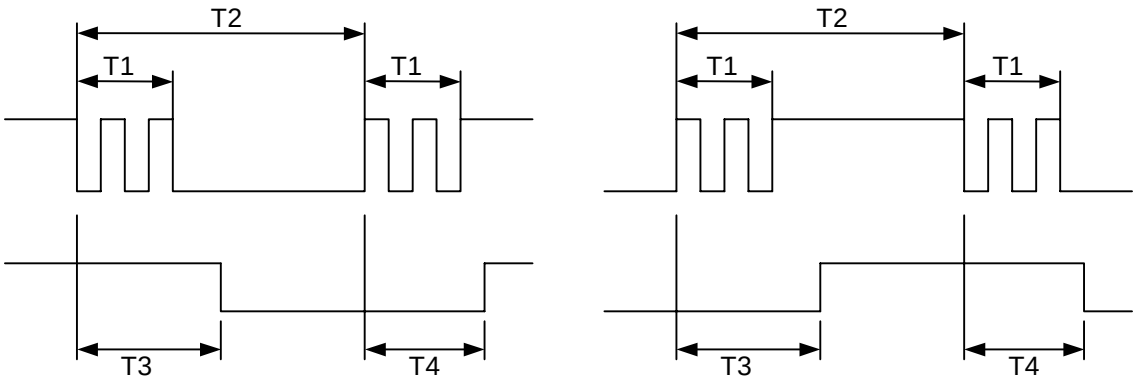
The input signals must be used within the following condition ranges.

Sink type

Input voltage at external contact ON	6V or less
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	20V or more, 25.2V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	3ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2 below)
Input circuit operation delay time	$3ms \leq T3 \fallingdotseq T4 \leq 16ms$
Machine side contact capacity	30V or more, 16mA or more

Source type

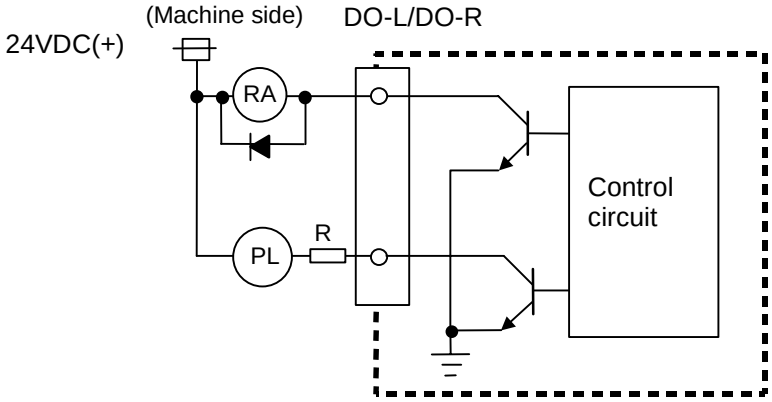
Input voltage at external contact ON	18V or more, 25.2V or less
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	4V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	3ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2 below)
Input circuit operation delay time	$3ms \leq T3 \fallingdotseq T4 \leq 16ms$
Machine side contact capacity	30V or more, 16mA or more



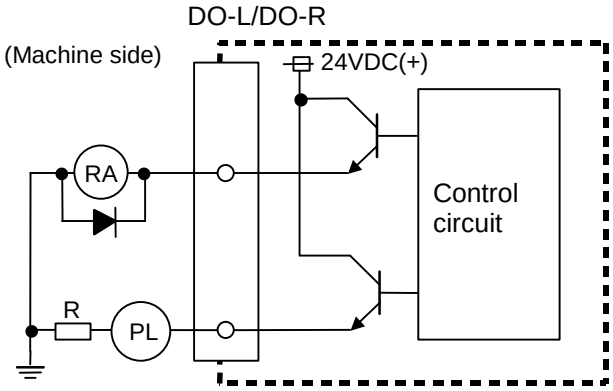
6.6 Outline of Digital Signal Output Circuit

The digital signal output circuit uses a sink type (DX1□0) or source type (DX1□1).
Use within the specification ranges shown below.

Output circuit



Sink type (DX1□0)



Source (DX1□1)

Output conditions

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	60mA
Output delay time	40μs

<CAUTION>

When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, 100mA or more) in parallel to the load.

When using a capacity load such as a lamp, always connect a protective resistor (R=150Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the instantaneous current.)

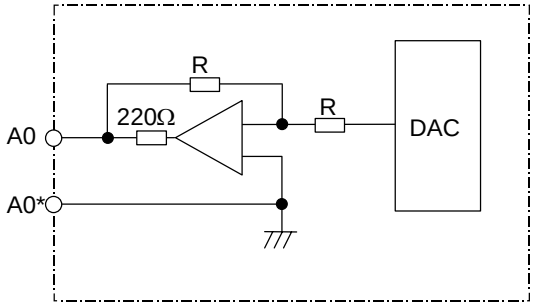
⚠ CAUTION

- **When using an inductive load such as relays, always connect a diode in parallel to the load as a noise countermeasure.**
- **When using a capacitive load such as a lamp, always connect a protective resistor in series to the load to suppress rush currents.**

6.7 Outline of Analog Signal Output Circuit

The analog signal output circuit can be used only for the FCUA-DX120/DX121/DX140/DX141.

Output circuit



Output conditions

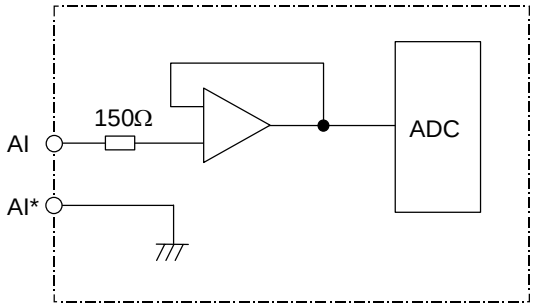
Output voltage	0V to ±10V (±5%)
Resolution	12bit (±10V × n/4096) **(Note)**
Load conditions	10kΩ load resistance
Output impedance	220Ω

(Note) n = (2^0 to 2^{11})

6.8 Outline of Analog Signal Input Circuit

The analog signal input circuit can be used only for the FCUA-DX140/DX141.

Input circuit

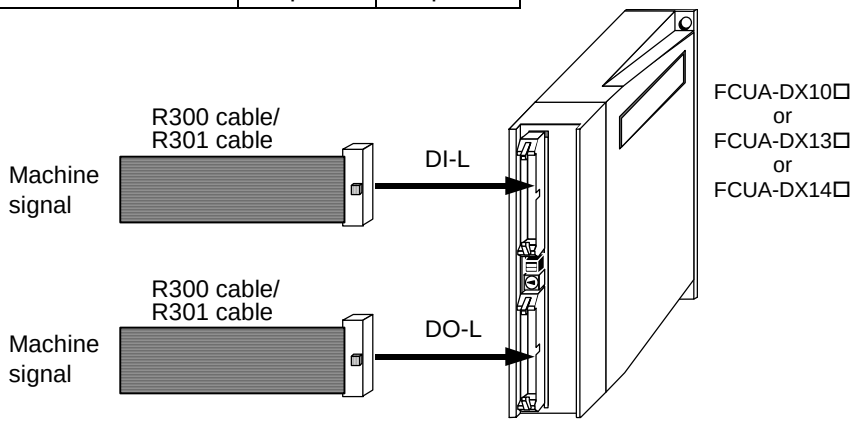


Input conditions

Max. input rating	±15V
Resolution	10V/2000 (5mV)
Precision	Within ±25mV
AD input sampling time	14.2ms (AI0)/42.6ms (AI1 to 3)

6.9 Connection of FCUA-DX10□ /13□ /14□ Unit and Machine Control Signal

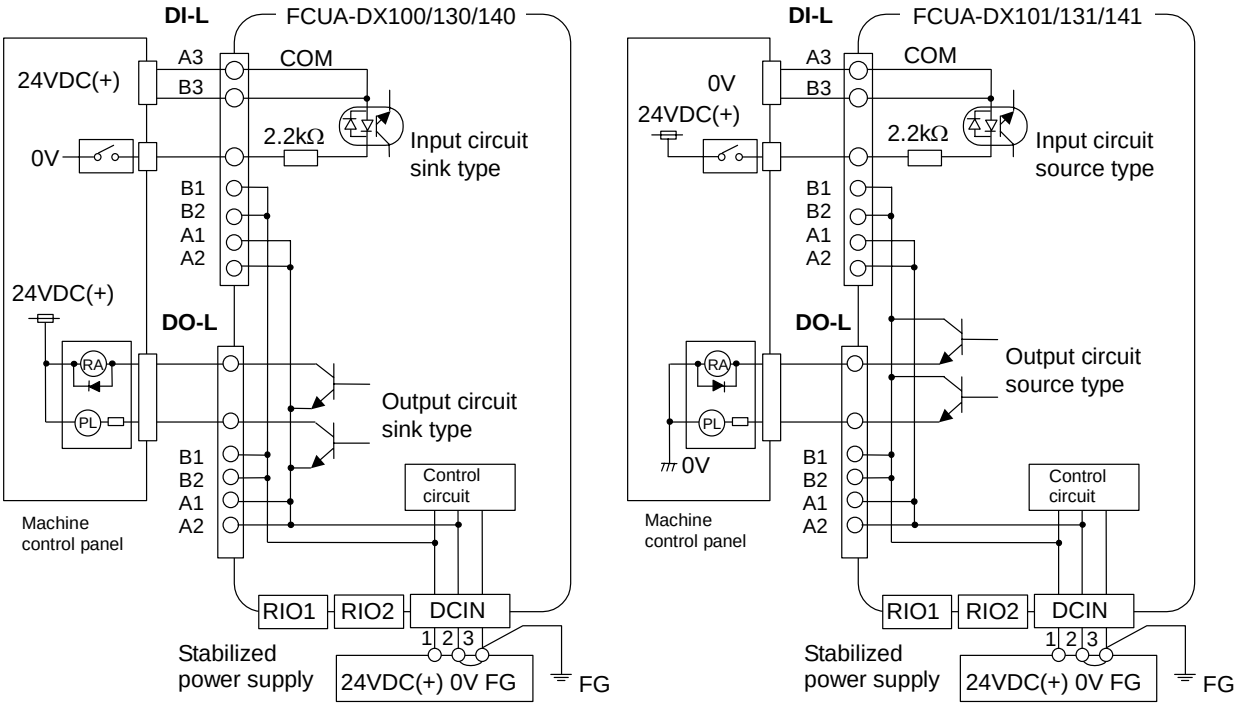
Type of machine input/output signal and No. of points	Input	Output
	32 points	32 points



The remote I/O unit cable types include the R300 and R301 cables. The R300 cable has one end cut off, and the R301 cable is used for connection to the Izumi Denki terminal block BX1F-T40A **(Note 1)**. The R300-3M and R301-3M cables are available. If a cable longer than 3m is required, use the CN300 and CS301 connector set.
The CN300 connector set (optional, with one end) includes the DI-L and DO-L connectors. The CS301 connector set (optional, with both ends) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block (Izumi Denki).

(Note 1) Izumi Denki I/O terminal BX1F-T40

<Outline of connection>

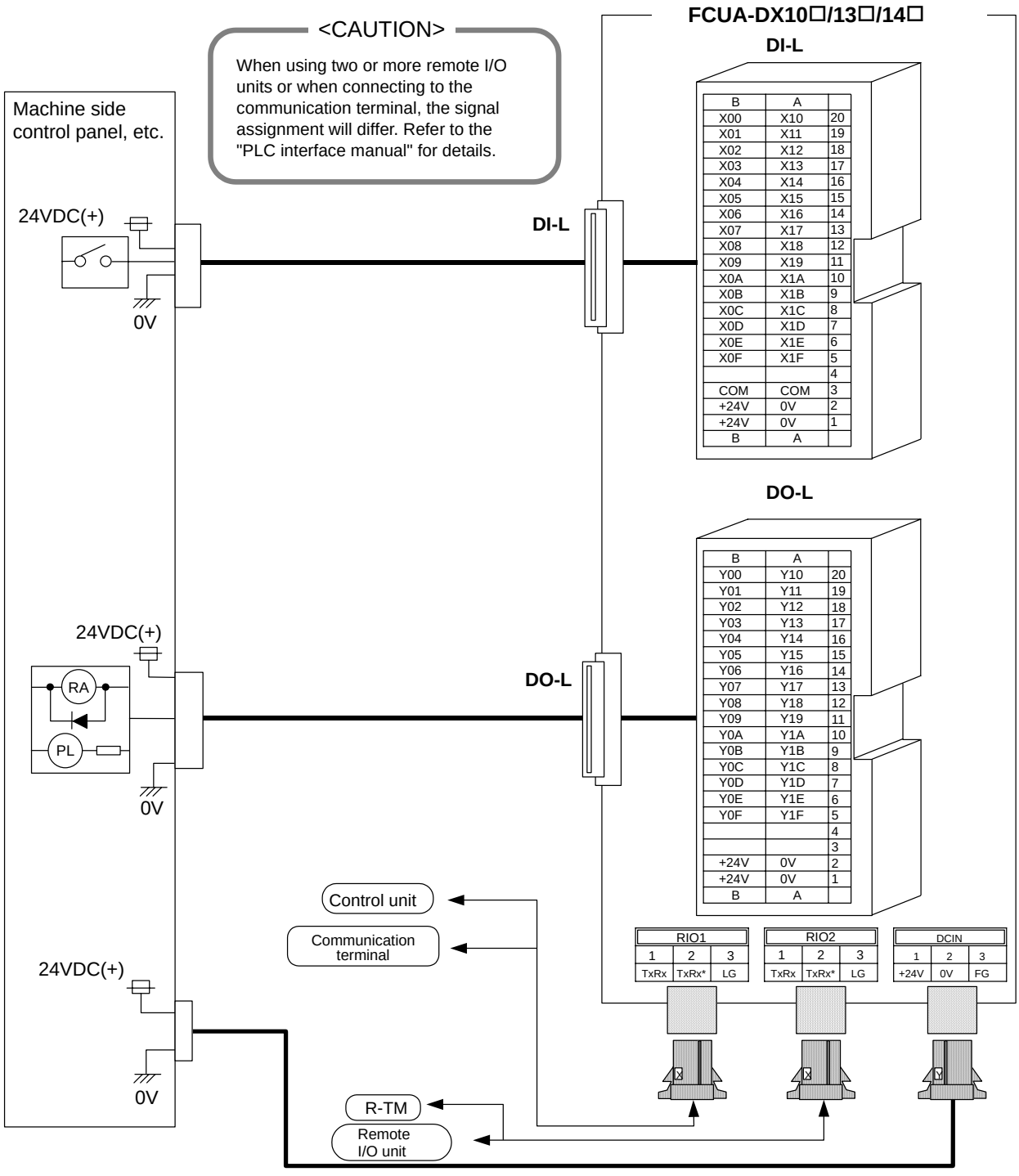


⚠ CAUTION

⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

<Signal assignment table>

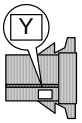


B	A	
X00	X10	20
X01	X11	19
X02	X12	18
X03	X13	17
X04	X14	16
X05	X15	15
X06	X16	14
X07	X17	13
X08	X18	12
X09	X19	11
X0A	X1A	10
X0B	X1B	9
X0C	X1C	8
X0D	X1D	7
X0E	X1E	6
X0F	X1F	5
		4
COM	COM	3
+24V	0V	2
+24V	0V	1
B	A	

B	A	
Y00	Y10	20
Y01	Y11	19
Y02	Y12	18
Y03	Y13	17
Y04	Y14	16
Y05	Y15	15
Y06	Y16	14
Y07	Y17	13
Y08	Y18	12
Y09	Y19	11
Y0A	Y1A	10
Y0B	Y1B	9
Y0C	Y1C	8
Y0D	Y1D	7
Y0E	Y1E	6
Y0F	Y1F	5
		4
		3
+24V	0V	2
+24V	0V	1
B	A	

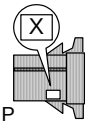
<Adaptive connector>

DCIN (CN220)



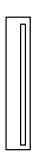
Connector : 2-178288-3
Contact : 1-175218-5
Maker : Tyco Electronics AMP

RIO1/RIO2 (CN211)



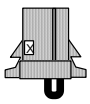
Connector : 1-178288-3
Contact : 1-175218-2
Maker : Tyco Electronics AMP

DI-L/DO-L (CN300)



Crimp type :7940-6500SC connector
Maker : Sumitomo 3M

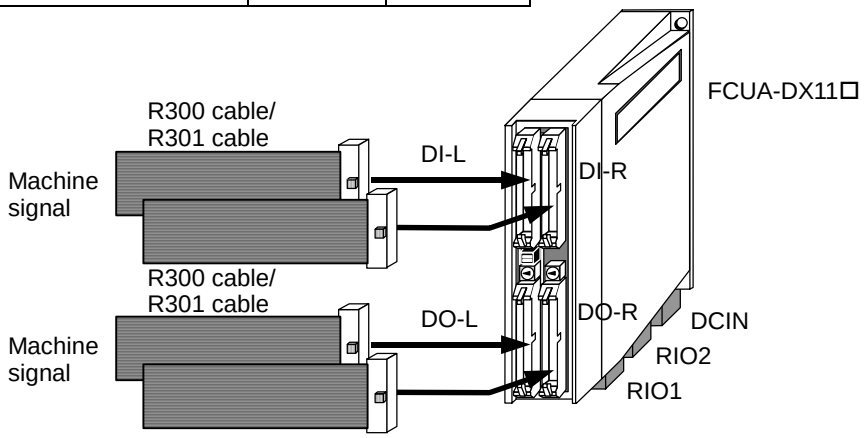
Terminator (R-TM)



Maker: Tyco Electronics AMP

6.10 Connection of FCUA-DX11☐ Unit and Machine Control Signal

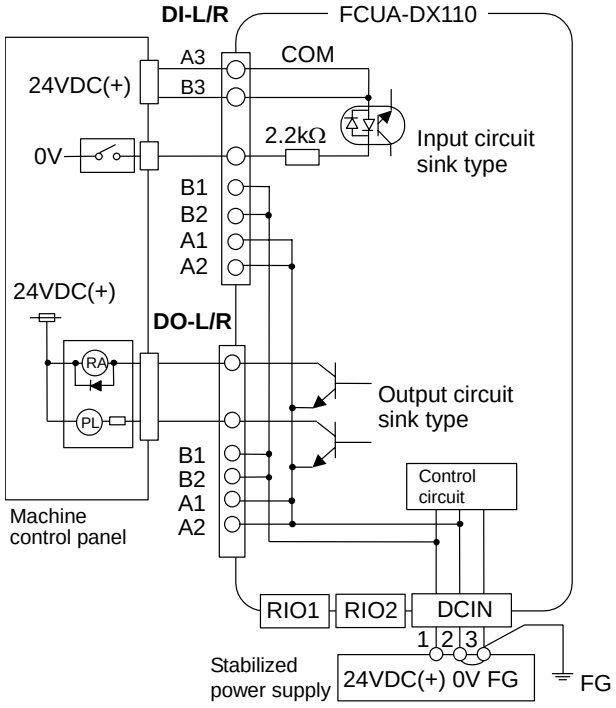
Type of machine input/output signal and No. of points	Input	Output
	64 points	48 points

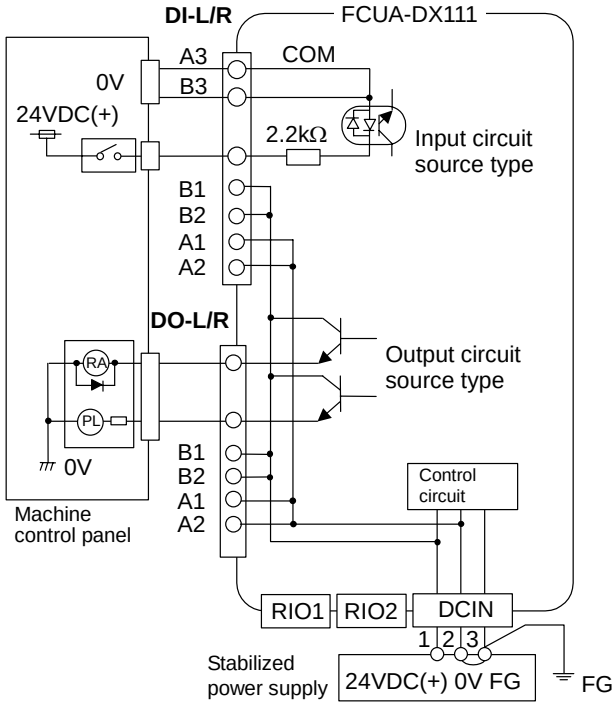


The remote I/O unit cable types include the R300 and R301 cables. The R300 cable has one end cut off, and the R301 cable is used for connection to the Izumi Denki terminal block BX1F-T40A (**Note 1)**. The R300-3M and R301-3M cables are available. If a cable longer than 3m is required, use the CN300 and CS301 connector set.
The CN300 connector set (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The CS301 connector set (optional, with both ends) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block (Izumi Denki).

(Note 1) Izumi Denki I/O terminal BX1F-T40

<Outline of connection>



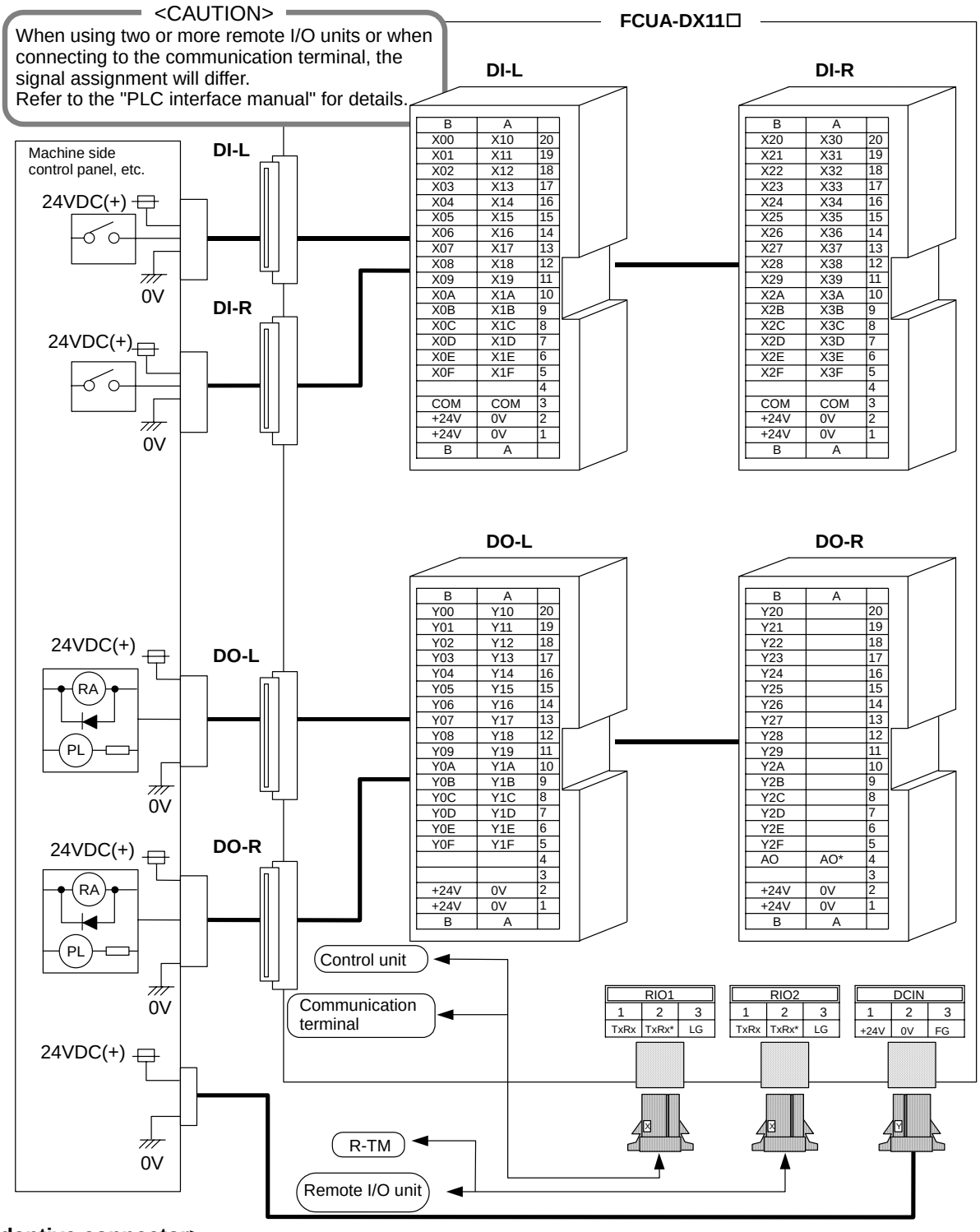


⚠ CAUTION

⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.

<Signal assignment table>



B	A	
X00	X10	20
X01	X11	19
X02	X12	18
X03	X13	17
X04	X14	16
X05	X15	15
X06	X16	14
X07	X17	13
X08	X18	12
X09	X19	11
X0A	X1A	10
X0B	X1B	9
X0C	X1C	8
X0D	X1D	7
X0E	X1E	6
X0F	X1F	5
		4
COM	COM	3
+24V	0V	2
+24V	0V	1
B	A	

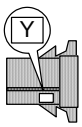
B	A	
X20	X30	20
X21	X31	19
X22	X32	18
X23	X33	17
X24	X34	16
X25	X35	15
X26	X36	14
X27	X37	13
X28	X38	12
X29	X39	11
X2A	X3A	10
X2B	X3B	9
X2C	X3C	8
X2D	X3D	7
X2E	X3E	6
X2F	X3F	5
		4
COM	COM	3
+24V	0V	2
+24V	0V	1
B	A	

B	A	
Y00	Y10	20
Y01	Y11	19
Y02	Y12	18
Y03	Y13	17
Y04	Y14	16
Y05	Y15	15
Y06	Y16	14
Y07	Y17	13
Y08	Y18	12
Y09	Y19	11
Y0A	Y1A	10
Y0B	Y1B	9
Y0C	Y1C	8
Y0D	Y1D	7
Y0E	Y1E	6
Y0F	Y1F	5
		4
		3
+24V	0V	2
+24V	0V	1
B	A	

B	A	
Y20		20
Y21		19
Y22		18
Y23		17
Y24		16
Y25		15
Y26		14
Y27		13
Y28		12
Y29		11
Y2A		10
Y2B		9
Y2C		8
Y2D		7
Y2E		6
Y2F		5
AO	AO*	4
		3
+24V	0V	2
+24V	0V	1
B	A	

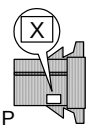
<Adaptive connector>

DCIN (CN220)



Connector :2-178288-3
Contact :1-175218-5
Maker : Tyco Electronics AMP

RIO1/RIO2 (CN211)

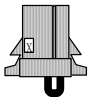


Connector :1-178288-3
Contact :1-175218-2
Maker : Tyco Electronics AMP

DI-L/DO-L (CN300)
DI-R/DO-R

Crimp type : 7940-6500SC connector
Maker : Sumitomo 3M

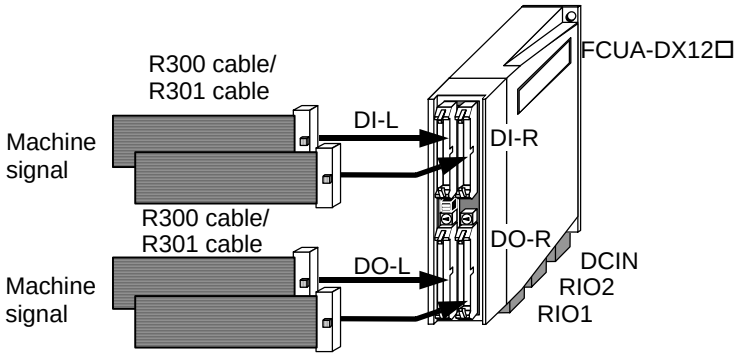
Terminator (R-TM)



Maker: Tyco Electronics AMP

6.11 Connection of FCUA-DX12☐ Unit and Machine Control Signal

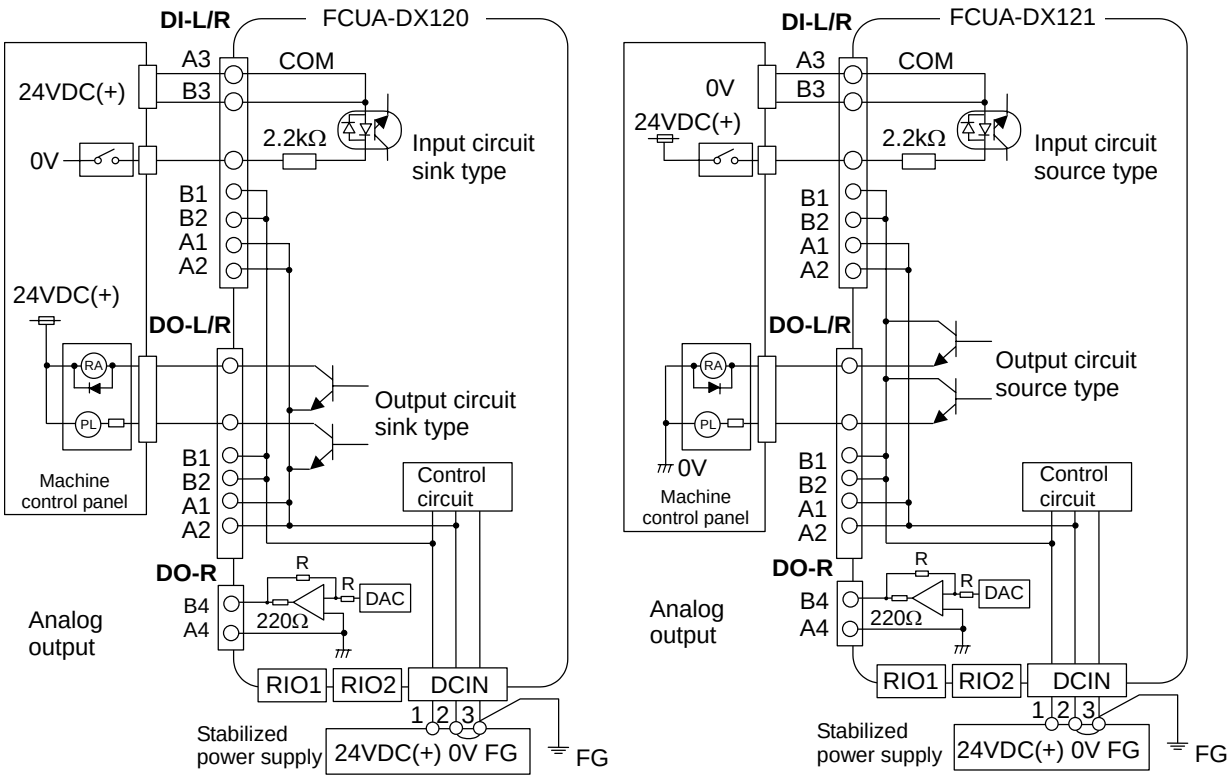
Type of machine input/output signal and No. of points	Input	Output	Analog output
	64 points	48 points	1 point



The remote I/O unit cable types include the R300 and R301 cables. The R300 cable has one end cut off, and the R301 cable is used for connection to the Izumi Denki terminal block BX1F-T40A **(Note 1)**. The R300-3M and R301-3M cables are available. If a cable longer than 3m is required, use the CN300 and CS301 connector set.
The CN300 connector set (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The CS301 connector set (optional, with both ends) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block (Izumi Denki).

(Note 1) Izumi Denki I/O terminal BX1F-T40

<Outline of connection>

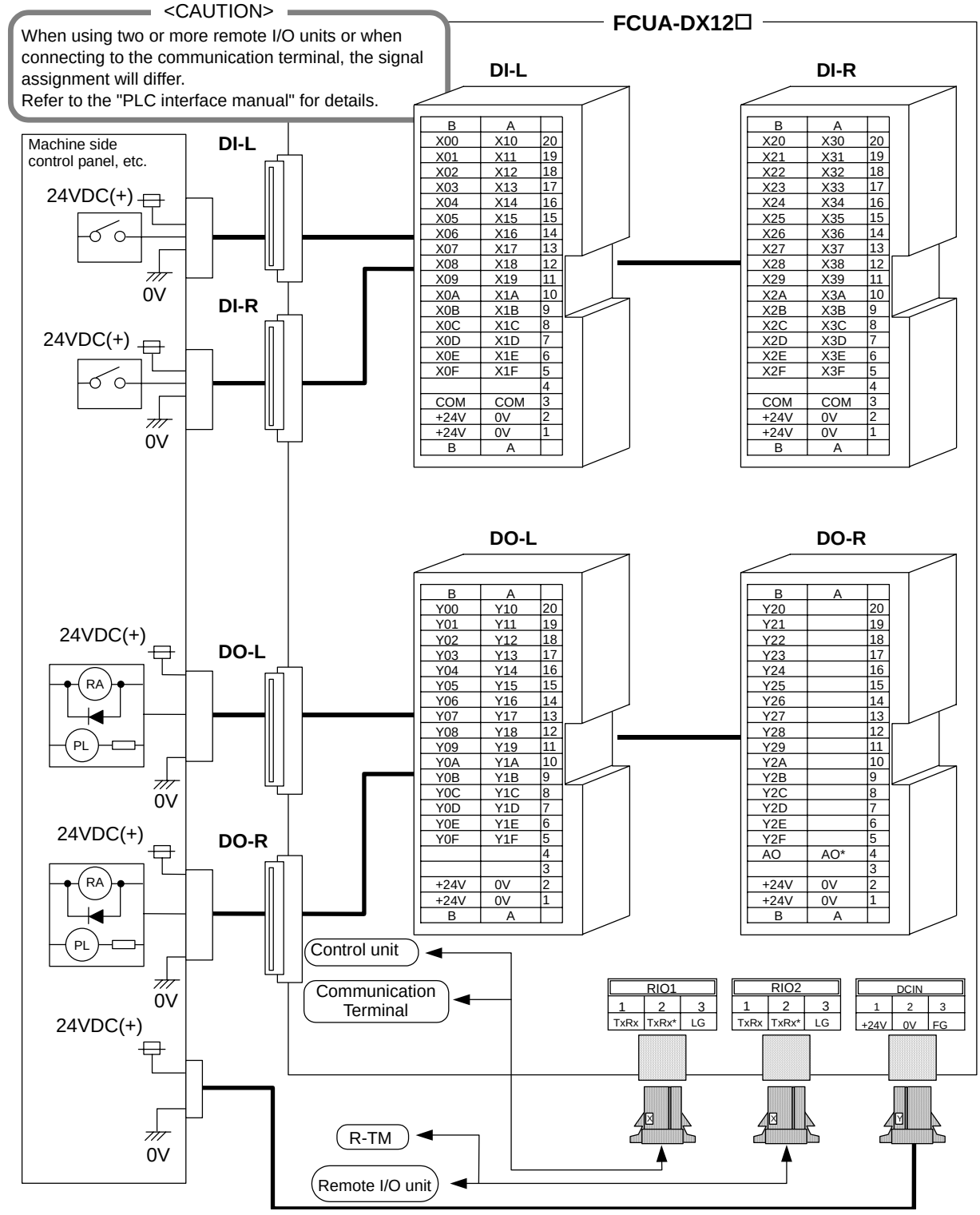


⚠ CAUTION

⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.

<Signal assignment table>



<Adaptive connector>

DCIN (CN220)

Connector : 2-178288-3
Contact : 1-175218-5
Maker : Tyco Electronics AMP

RIO1/RIO2 (CN211)

Connector :1-178288-3
Contact :1-175218-2
Maker : Tyco Electronics AMP

DI-L/DO-L (CN300)
DI-R/DO-R

Crimp type : 7940-6500SC connector
Maker : Sumitomo 3M

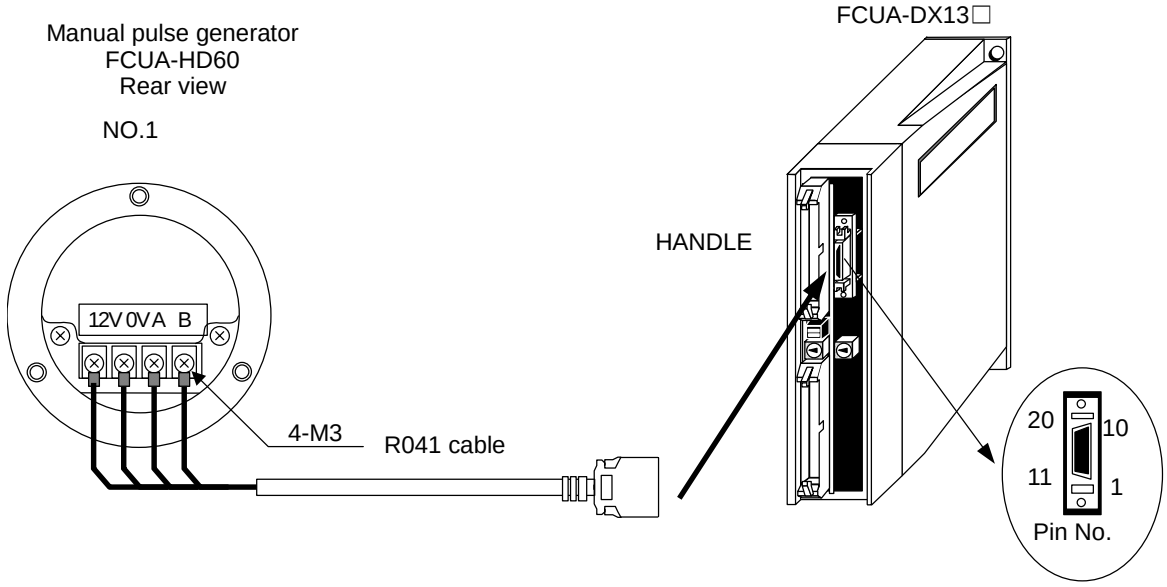
Terminator (R-TM)

Maker: Tyco Electronics AMP

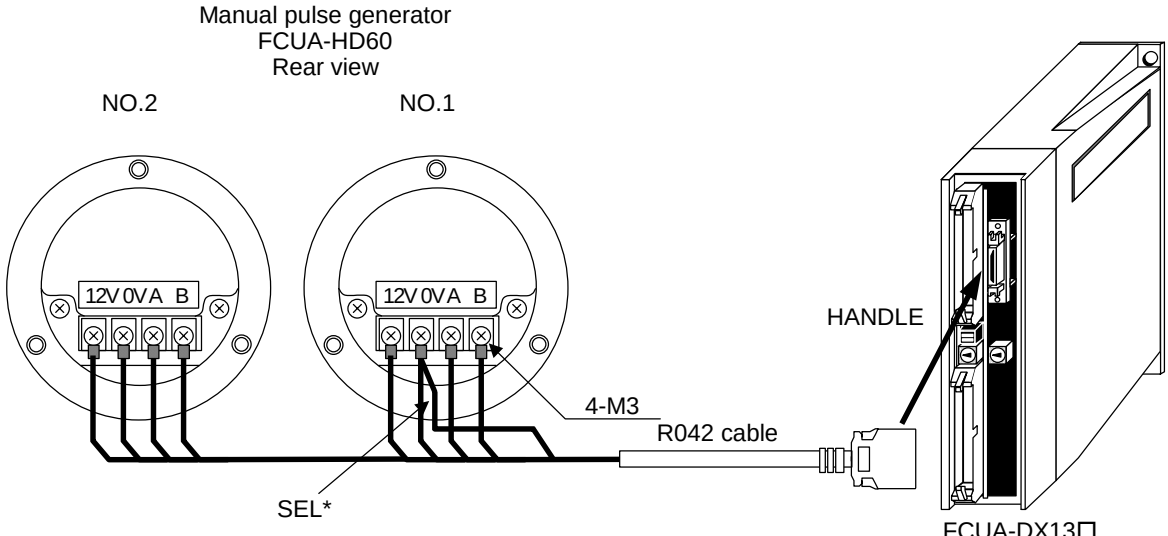
6.12 Connection of FCUA-DX13☐ Unit and Manual Pulse Generator

When connecting the manual pulse generator, the R041 or R042 cable is connected to HANDLE. Up to two manual pulse generators can be connected. Use the CS000 connector set (optional, with both ends) when manufacturing the R041 or R042 cable.

Connecting one manual pulse generator



Connecting two manual pulse generators



When connecting the second manual pulse generator, connect the SEL* signal to the No.1, 0V.

⚠ CAUTION

- **⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.**
- **⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.**

6.13 Outline of FCUA-DX13☐ Unit Pulse Input Circuit

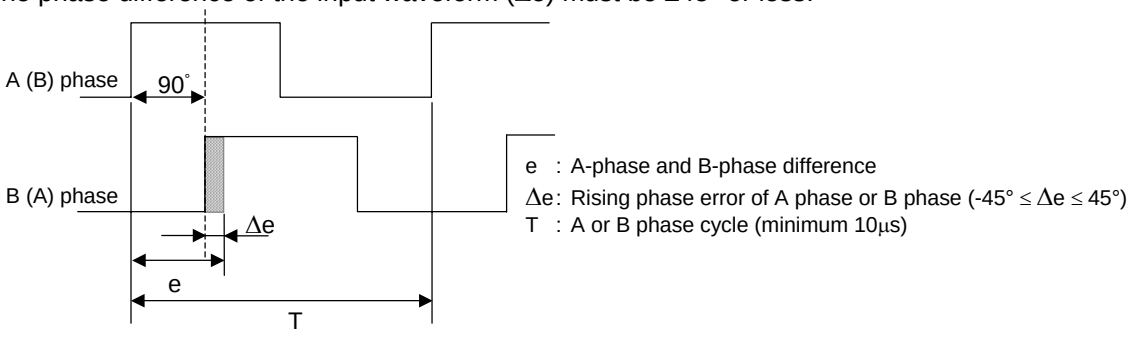
When connecting a pulse generator other than the manual pulse generator (FCUA-HD60) to the FCUA-DX13☐ unit, use within the specifications range given below.
Commercially available pulse generators include the 25P/R type and the 100P/R type. A pulse is multiplied by four internally, so use the 25P/R type.

Input/output conditions

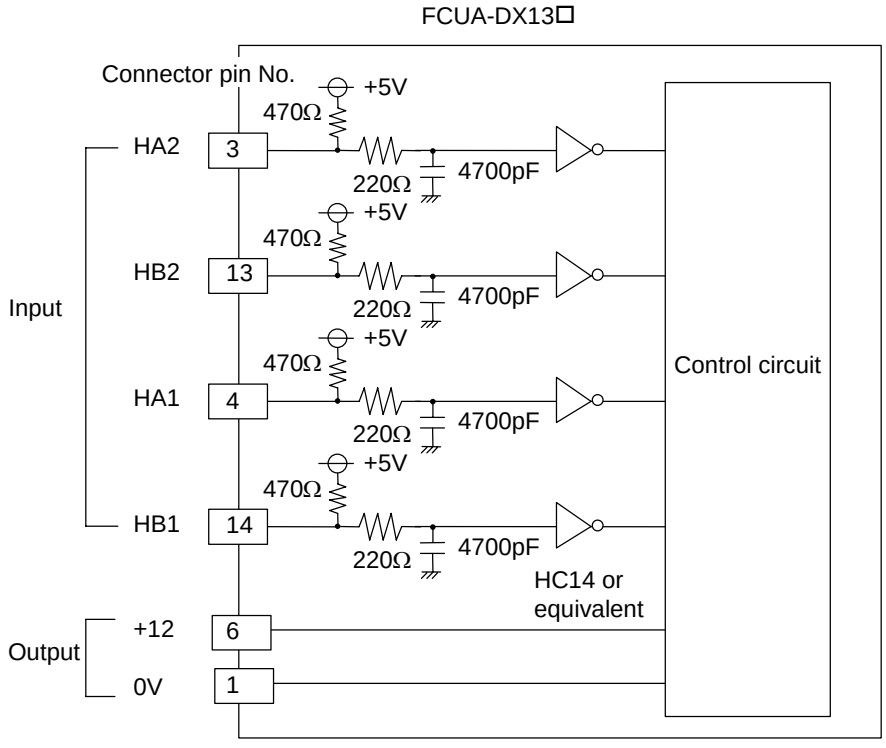
Input pulse signal format	A-phase and B-phase difference 90° (Refer to waveform (e) below)
Input signal voltage	H level 3.5V to 5.25V, L level 0V to 0.5V
Input pulse maximum frequency	100kHz
Pulse generator power voltage	12VDC ± 10%
Maximum output current	300mA
Number of pulses per rotation	25P/R (FCUA-HD60 is 25P/R)

Input waveform

The phase difference of the input waveform (Δe) must be ±45° or less.



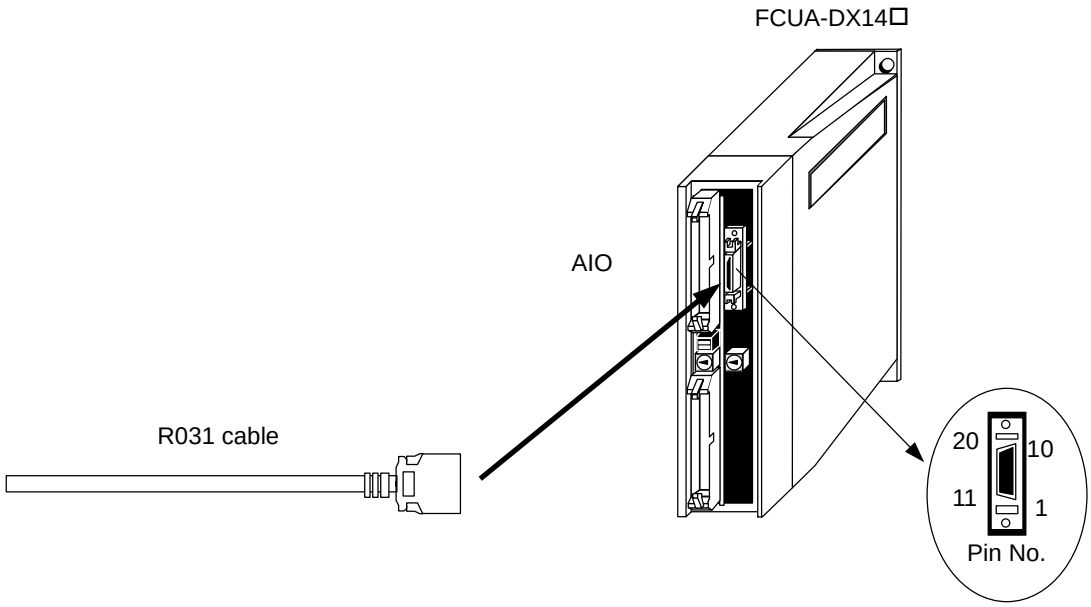
Input/output circuit



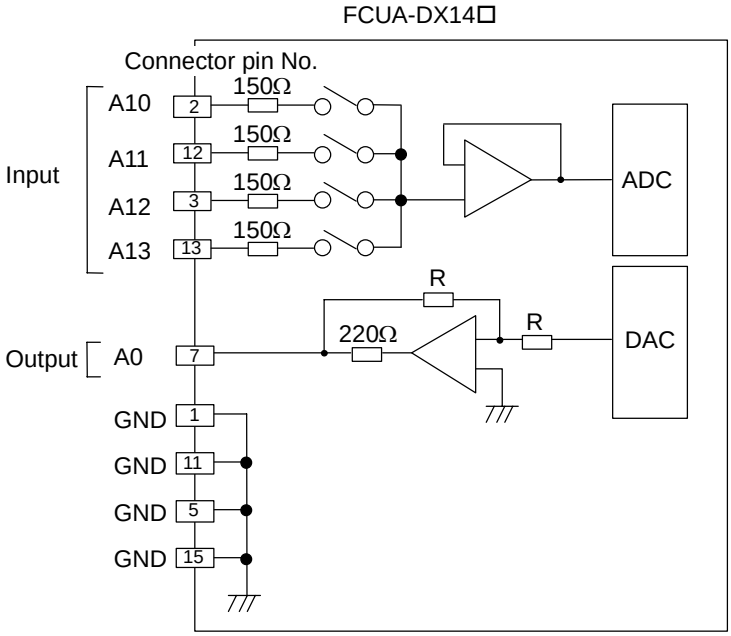
R041-3M (for one) and R042-3M (for two) are prepared for the handle cable.

6.14 Connection of FCUA-DX14□ Unit and Analog Input/Output Signal

For the analog input/output signal, the R031 cable is connected to AI0. Up to four input points and one output point of the analog input/output signal can be connected. When manufacturing the R031 cable, use the CS000 connector set (optional, with both ends).



Input/output circuit



⚠ CAUTION

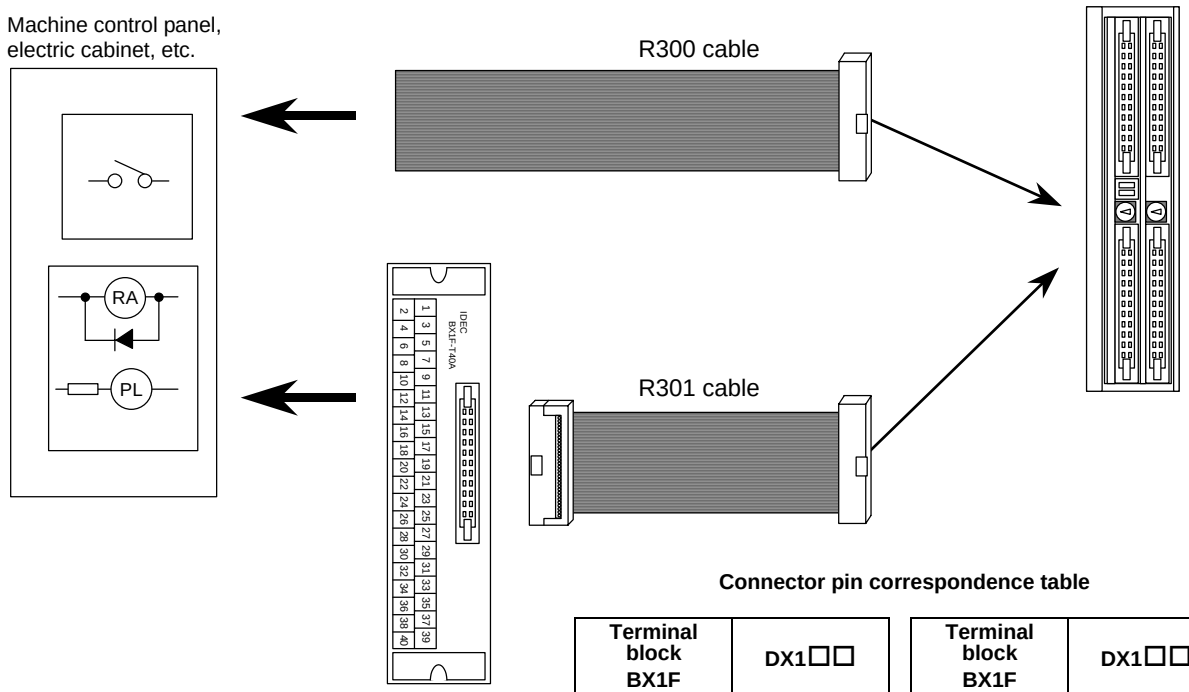
⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.

6.15 Cables

The remote I/O unit cable types include the R300 and R301 cables. The R300 cable has one end cut off, and the R301 cable is used for connections with the Izumi Denki terminal block BX1F-T40A **(Note 1)**. The R300-3M and R301-3M cables are available.
If a cable longer than 3m is required, use the CN300 or CS301 connector set.
The R041-3M (one-piece) and R042-3M (two-piece) manual pulse generator cables are available. The analog input/output cable R031 must be prepared by the user.

(Note 1) Izumi Denki I/O terminal BX1F-T40A

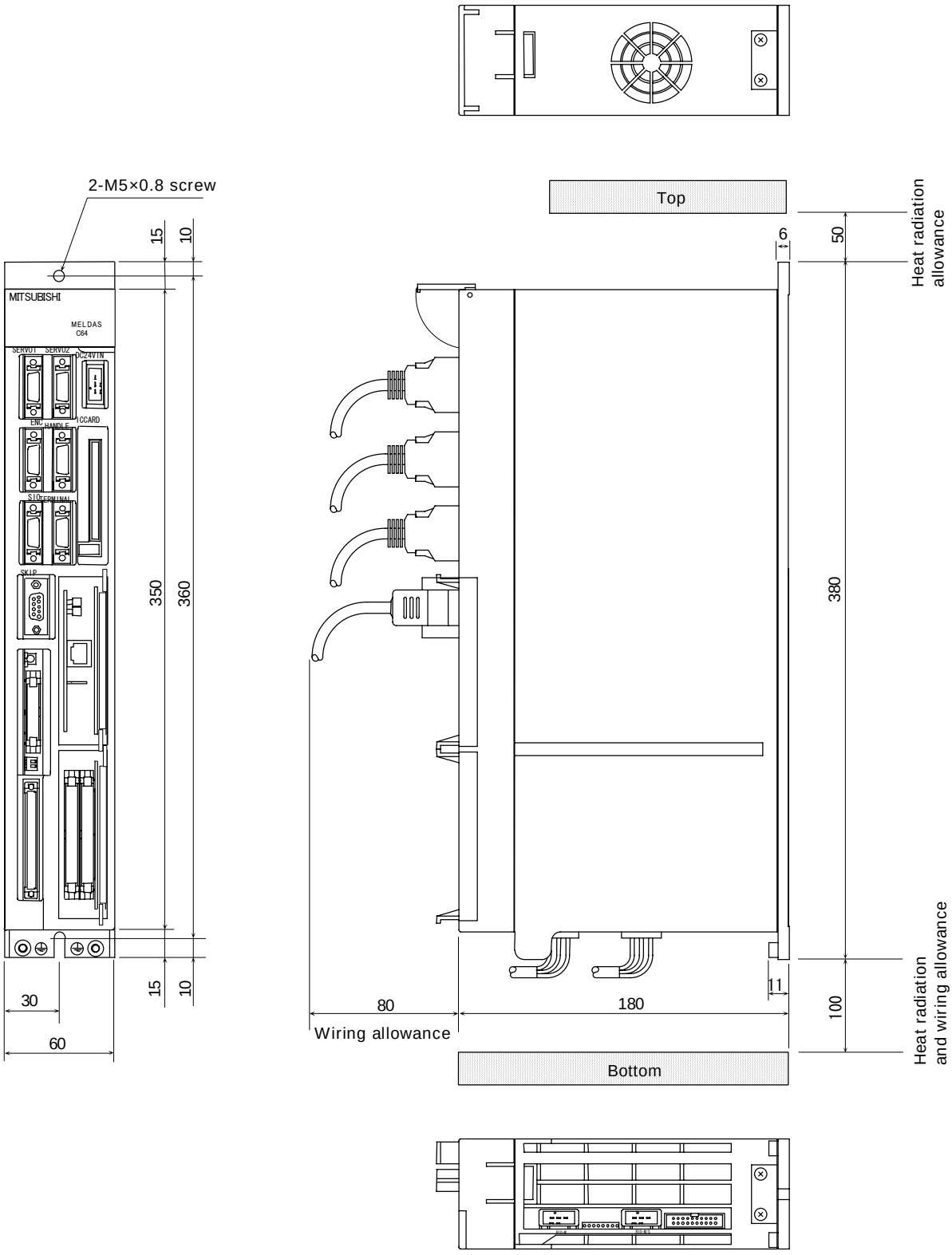


Connector pin correspondence table

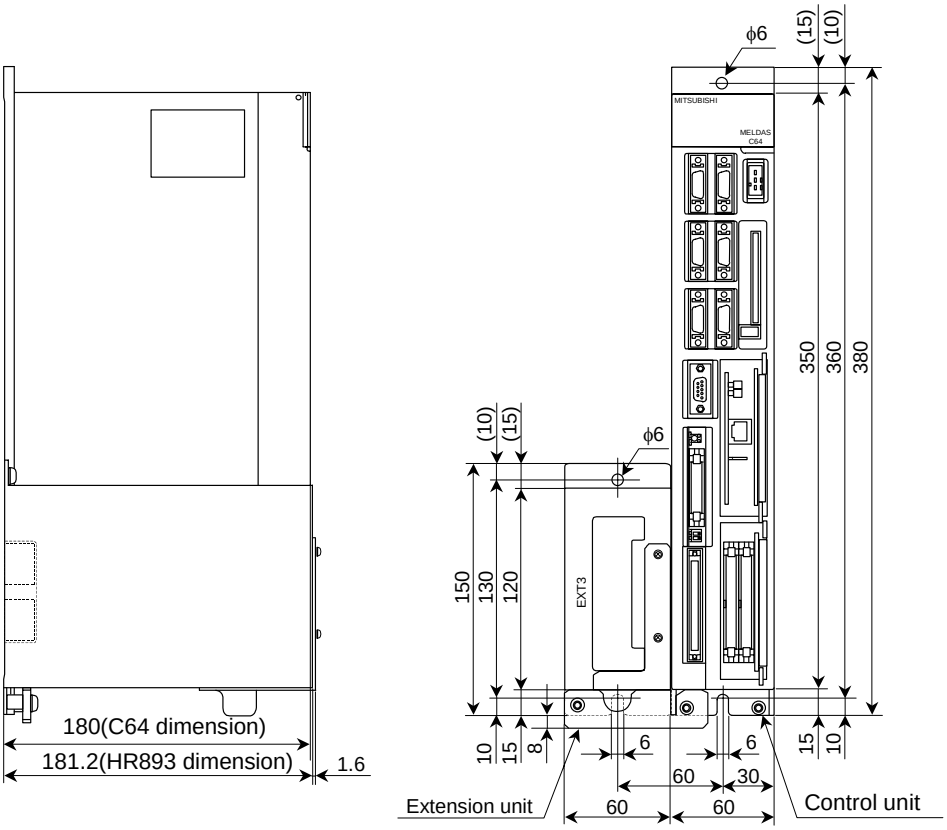
Terminal block BX1F	DX1☐☐	Terminal block BX1F	DX1☐☐
1	A1	2	B1
3	A2	34	B2
5	A3	6	B3
7	A4	8	B4
9	A5	10	B5
11	A6	12	B6
13	A7	14	B7
15	A8	16	B8
17	A9	18	B9
19	A10	20	B10
21	A11	22	B11
23	A12	24	B12
25	A13	26	B13
27	A14	28	B14
29	A15	30	B15
31	A16	32	B16
33	A17	34	B17
35	A18	36	B18
37	A19	38	B19
39	A20	40	B20

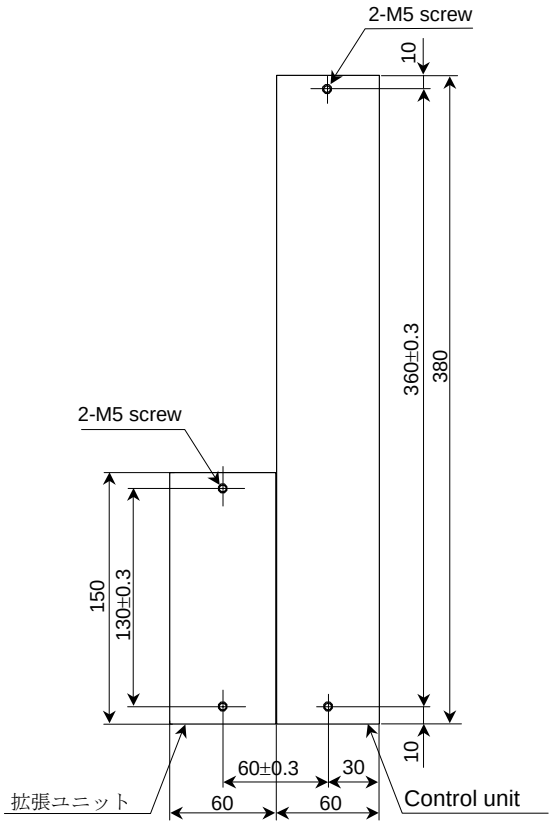
APPENDIX 1 OUTLINE AND INSTALLATION DIMENSIONS FOR CONTROL UNIT

Appendix 1.1 Outline and Installation Dimensions for Control Unit



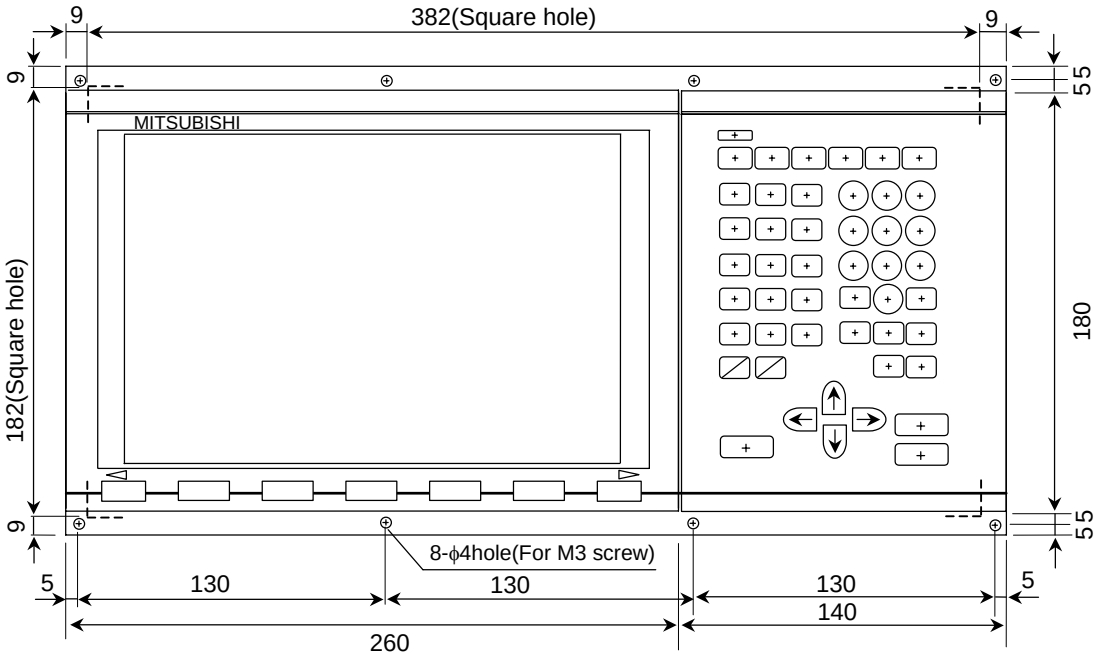
Appendix 1.2 Outline and Installation Dimensions for Control Unit with External Extension Unit

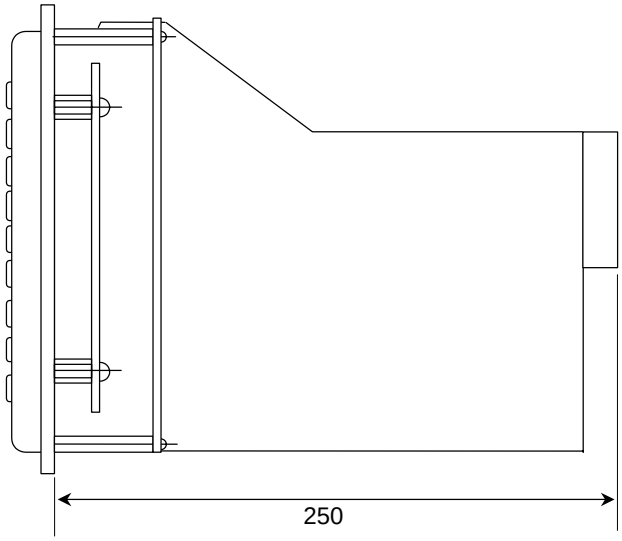


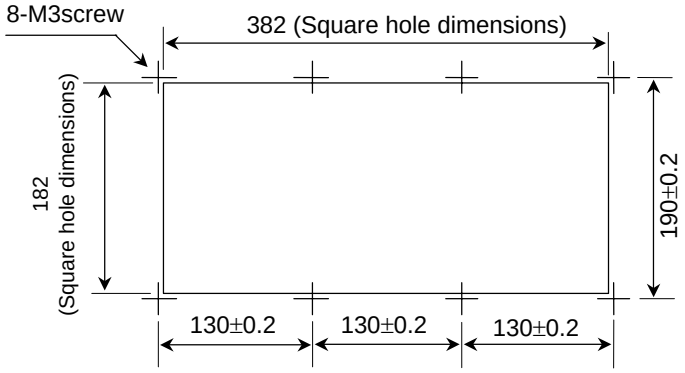


APPENDIX 2 OUTLINE AND INSTALLATION DIMENSIONS FOR COMMUNICATION TERMINAL

Appendix 2.1 Outline and Installation Dimensions for FCUA-CT100

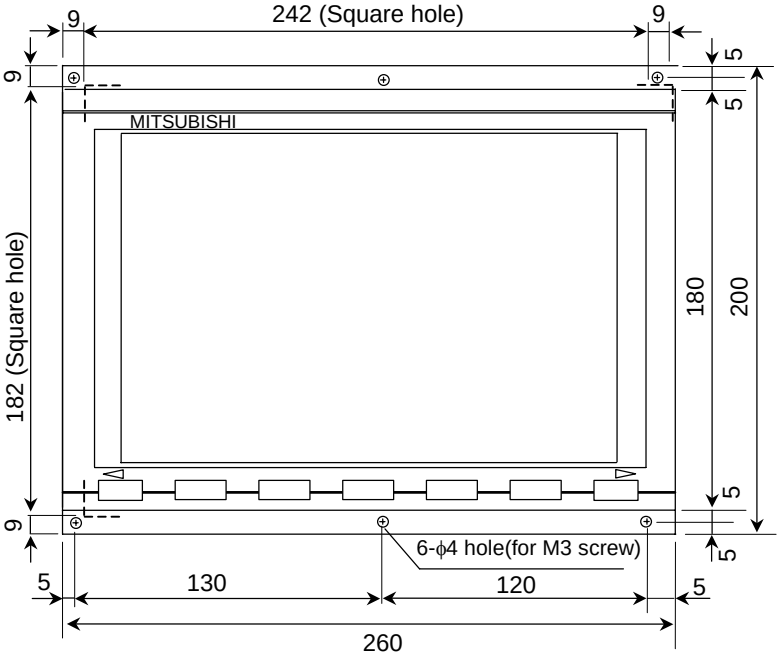


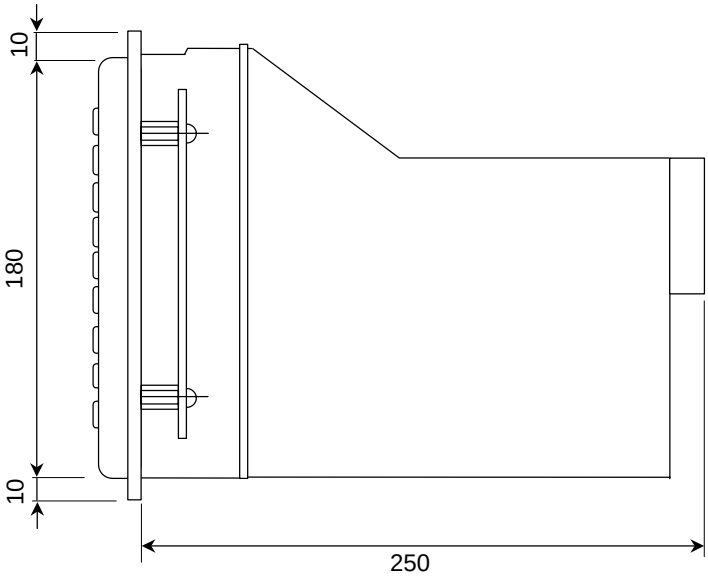


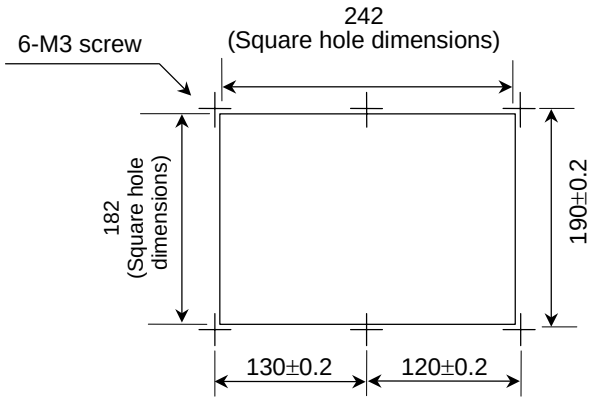


Panel cut drawing

Appendix 2.2 Outline and Installation Dimensions for FCUA-CR10

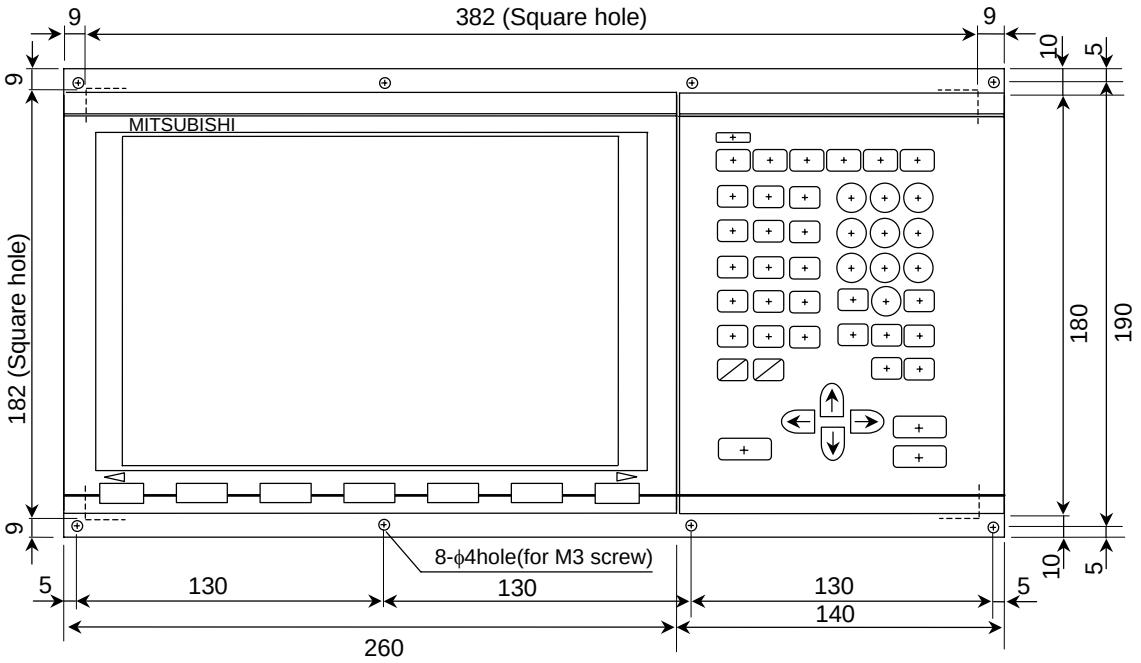


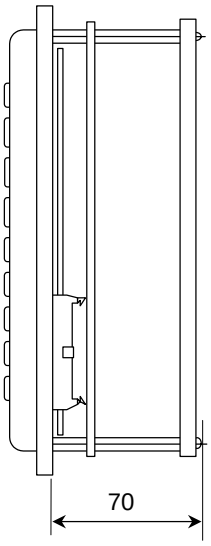


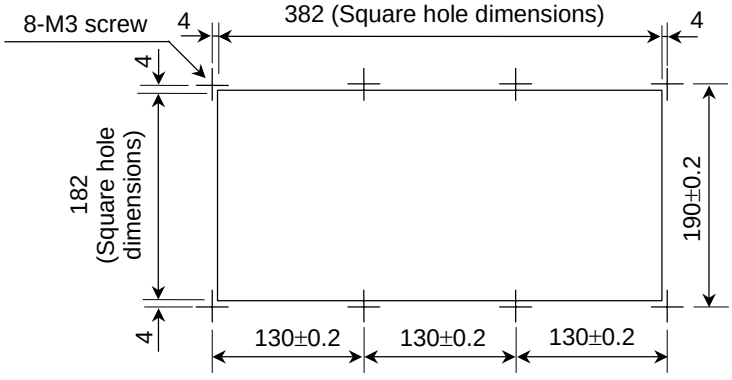


Panel cut drawing

Appendix 2.3 Outline and Installation Dimensions for FCUA-LD100

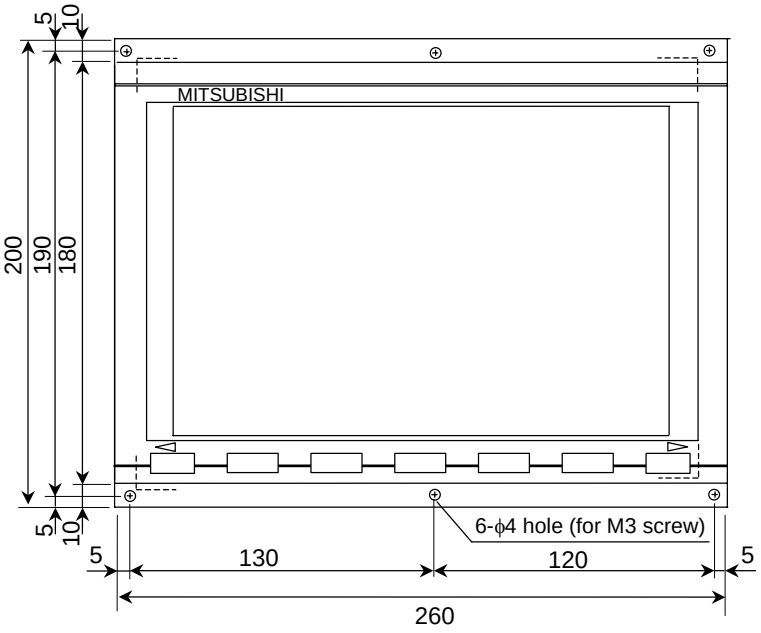


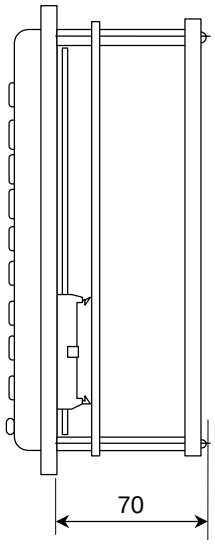


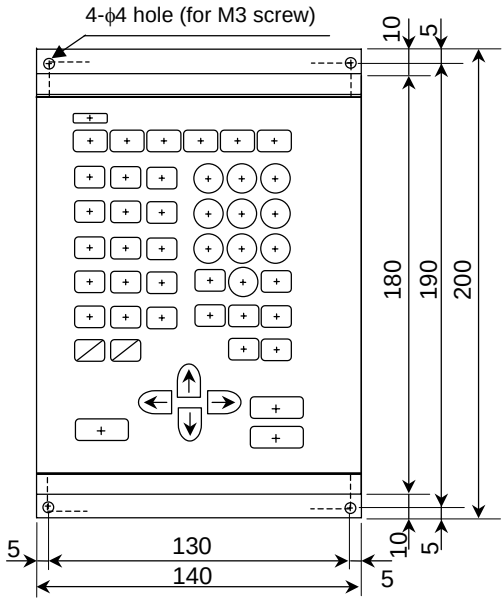


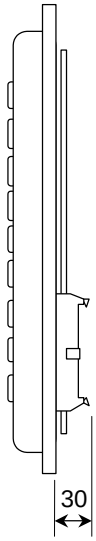
Panel cut drawing

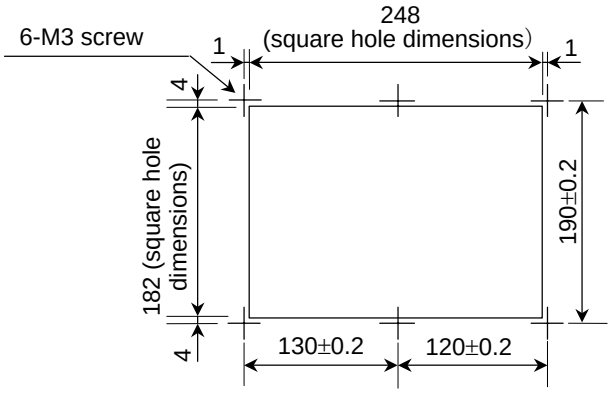
Appendix 2.4 Outline and Installation Dimensions for FCUA-LD10 and KB20

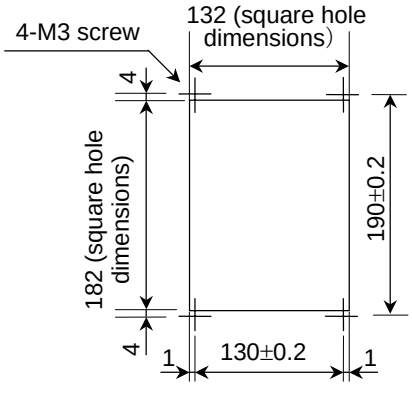






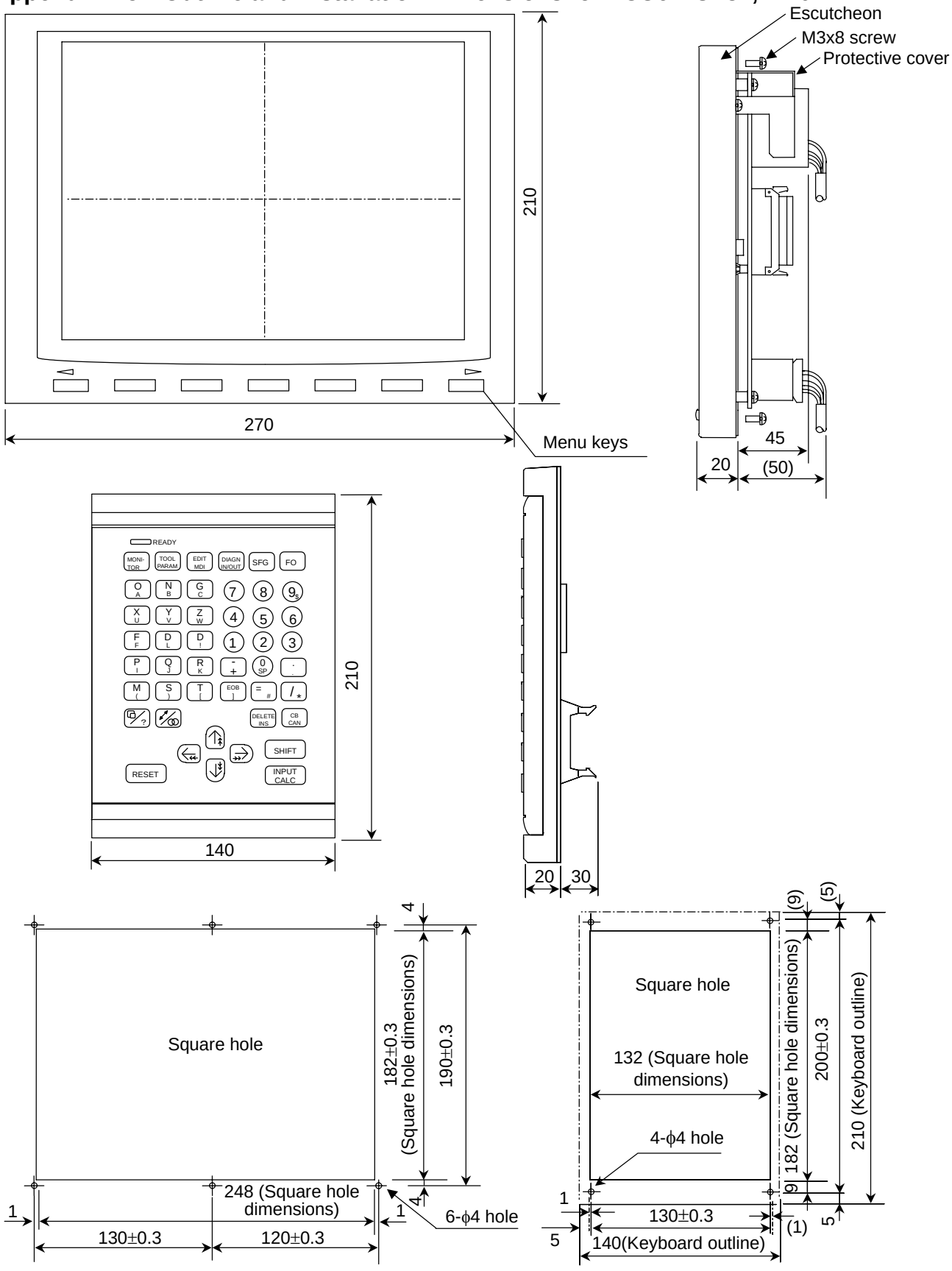






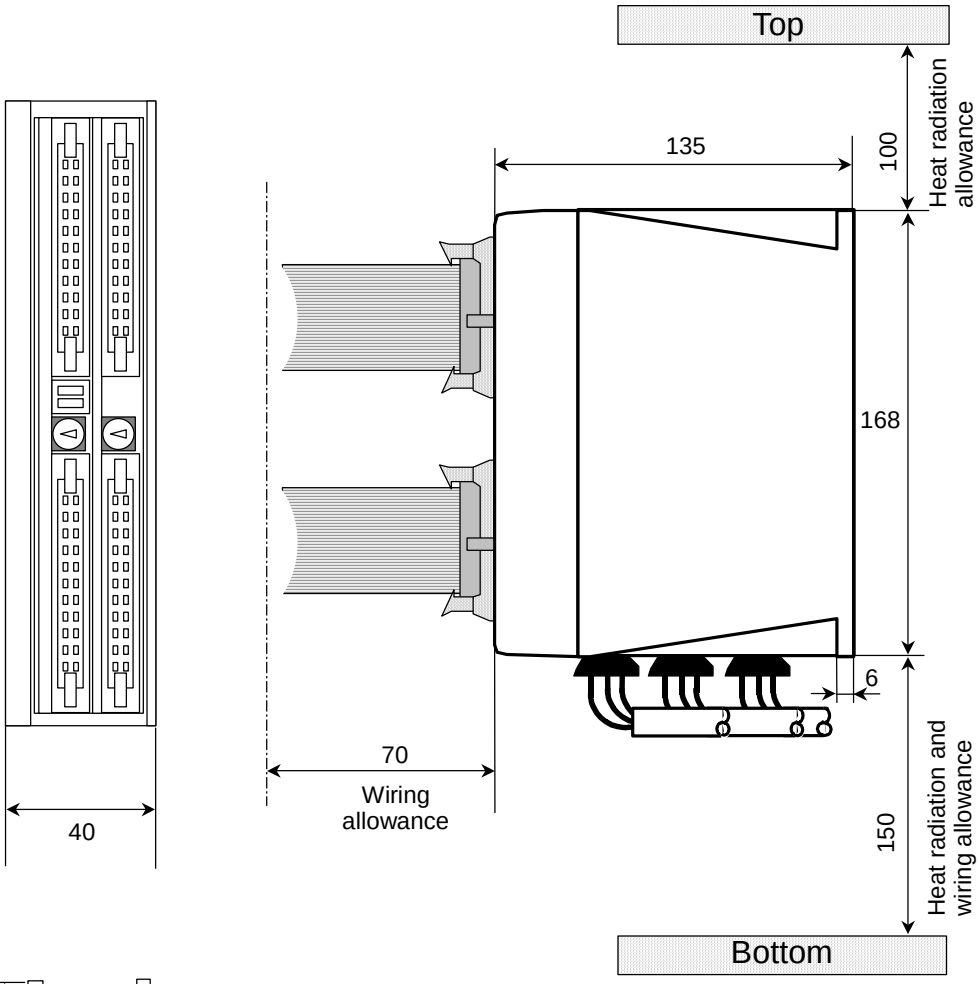
Panel cut drawing

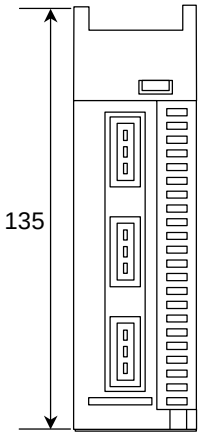
Appendix 2.5 Outline and Installation Dimensions for FCU6-DUT32, KB021

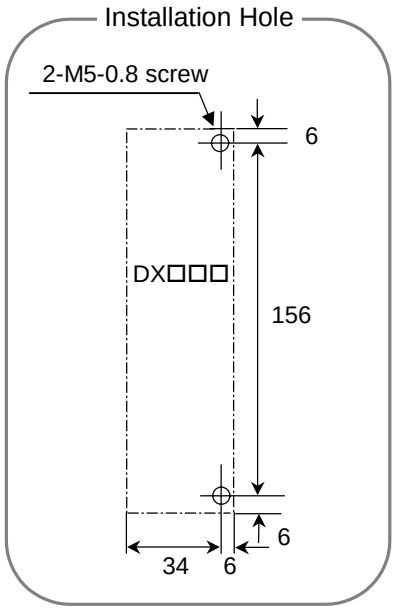


Panel cut drawing

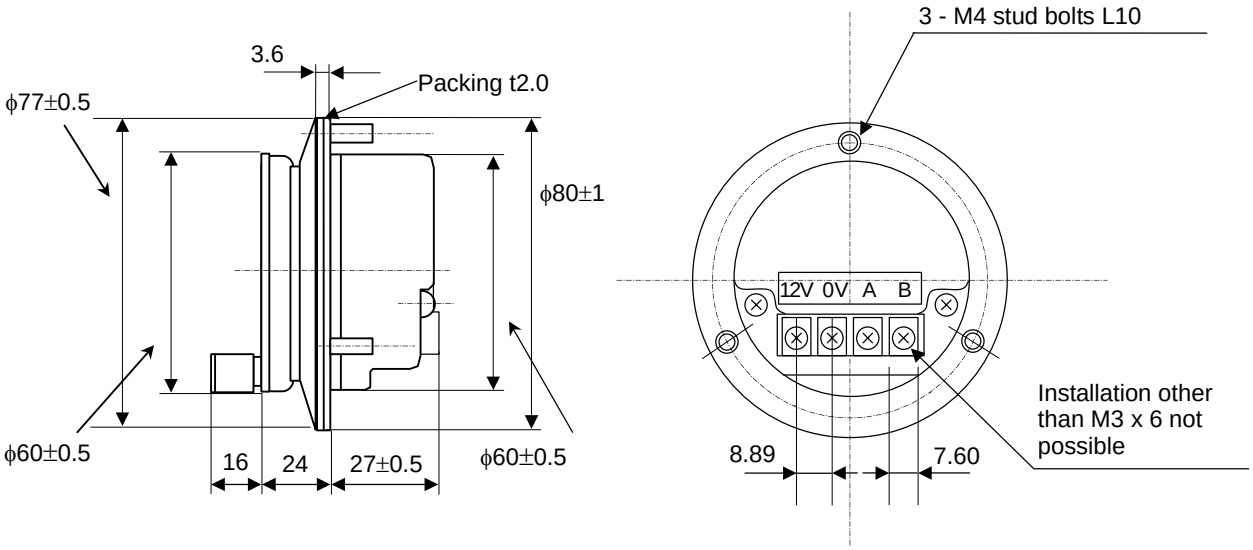
APPENDIX 3 OUTLINE AND INSTALLATION DIMENSIONS FOR REMOTE I/O UNIT

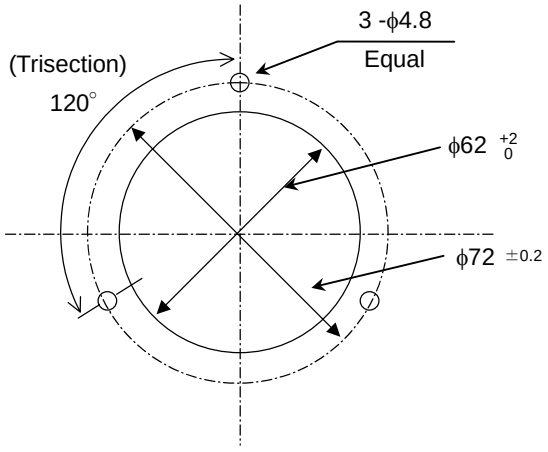






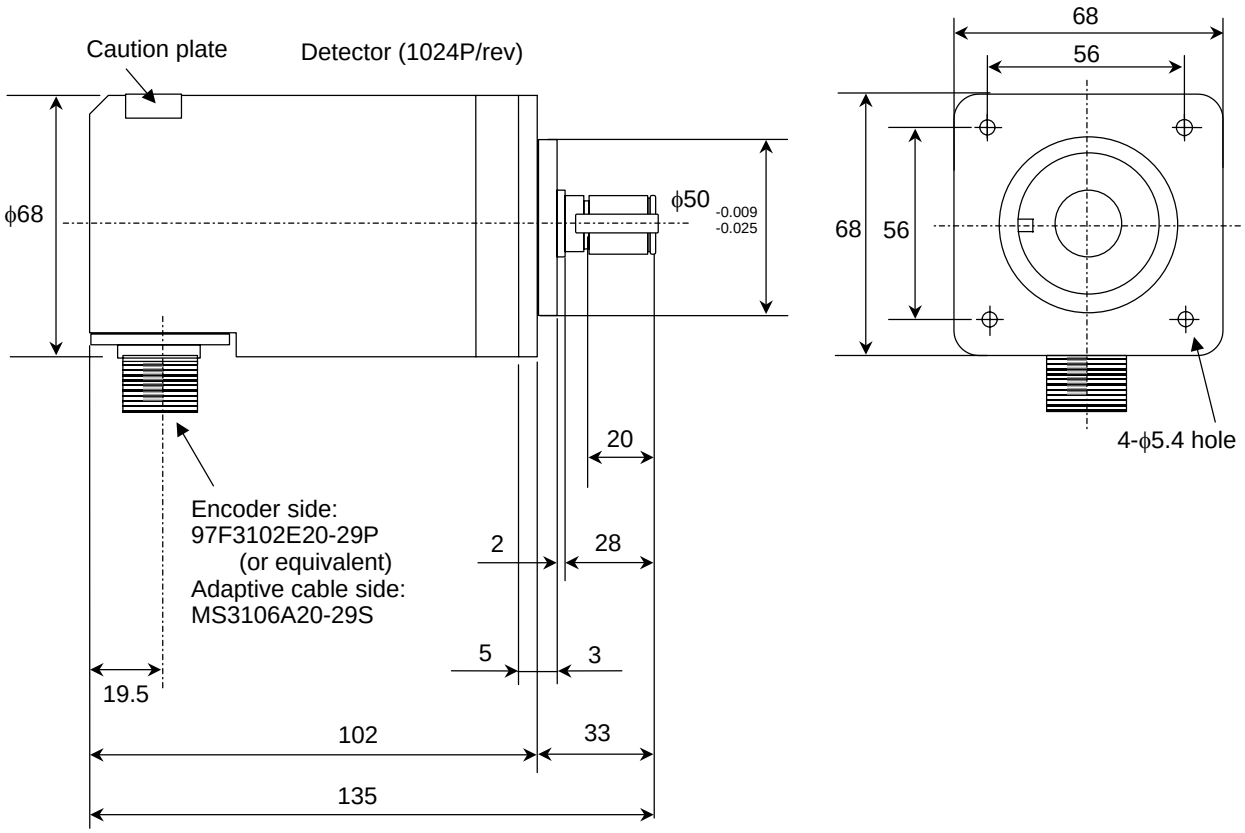
APPENDIX 4 OUTLINE AND INSTALLATION DIMENSIONS FOR MANUAL PULSE GENERATOR

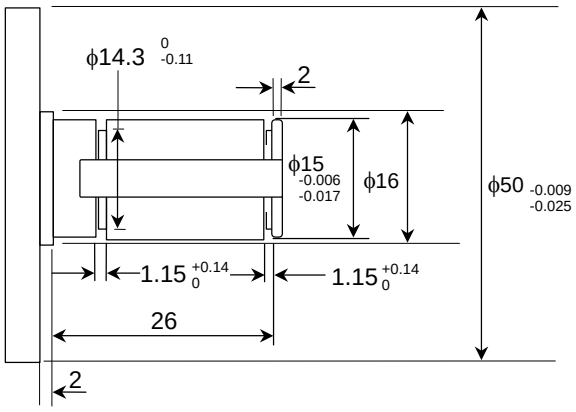




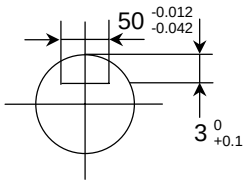
Panel cut drawing

APPENDIX 5 OUTLINE AND INSTALLATION DIMENSIONS FOR SYNCHRONOUS FEED ENCODER





Enlarged view of key



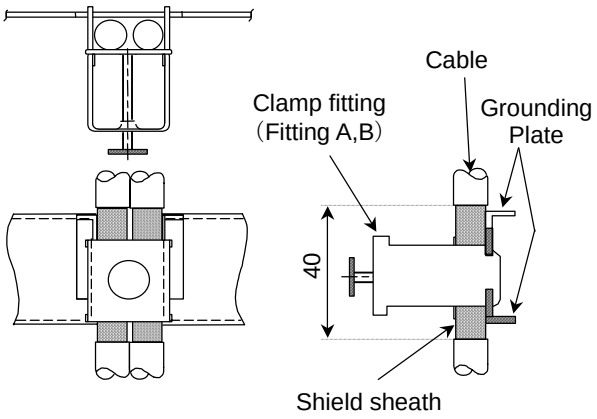
Cross-section BB

The effective depth of the key way is 21mm.

A	1chA	**K**	0V
B	2chZ	**L**	
C	3chB	**M**	
D		**N**	1ch$\overline{A}$
E	Case ground	**P**	2ch$\overline{Z}$
F		**R**	3ch$\overline{B}$
G		**S**	
H	+5V	**T**	
J			

APPENDIX 6 OUTLINE AND INSTALLATION DIMENSIONS FOR GROUNDING PLATE AND CLAMP FITTING

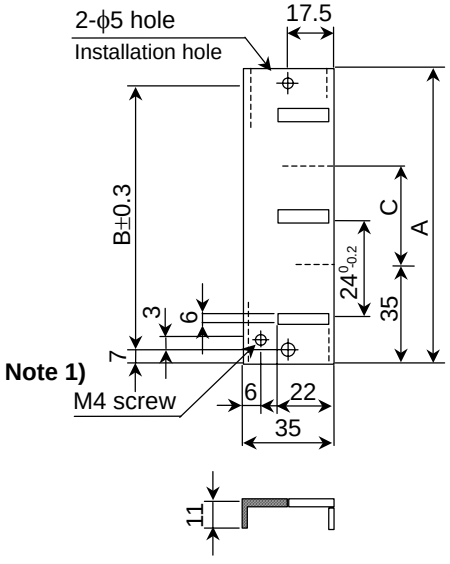
The shield wire generally only needs to be grounded to the connector's case frame. However, the effect can be improved by directly grounding to the grounding plate as shown on the right.
Install the grounding plate near each unit. Peel off part of the cable sheath as shown on the right to expose the shield sheath. Press that section against the grounding plate with the clamp fitting. Note that if the cable is thin, several can be clamped together.
Install the grounding plate directly onto the cabinet or connect a grounding wire so that sufficient frame grounding is achieved.
If the AERSBAN- □ SET, containing the grounding plate and clamp fitting, is required, please contact Mitsubishi.



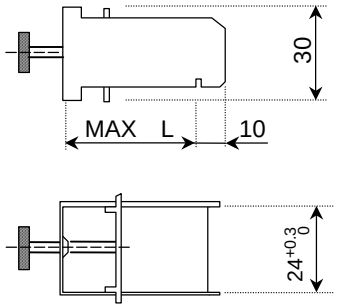
Clamp section drawing

Outline drawing

Grounding plate



Clamp fitting



Note 1) Screw hole for wiring to cabinet's grounding plate

Note 2) The grounding plate thickness is 1.6mm

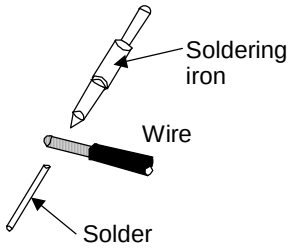
	A	B	C	Enclosed fittings
AERSBAN-DSET	100	86	30	Two clamp fittings A
AERSBAN-ESET	70	56	—	One clamp fitting B

	L
Clamp fitting A	70
Clamp fitting B	45

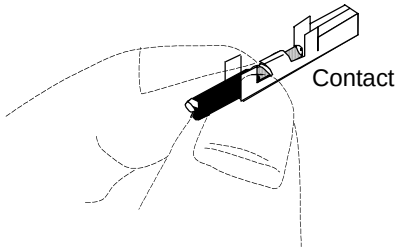
APPENDIX 7 CABLE MANUFACTURING DRAWINGS

As a rule, most F□□□/R□□□ cables used with this product are not sold by Mitsubishi. Thus, manufacture the required cables using the cable manufacturing drawings on the following pages as a reference. Note that the cable-compatible connectors can be purchased from Mitsubishi.
If crimp tools are not available when manufacturing the power supply cable (R200, R220) and communication cable (R211), the cables can be manufactured by soldering a wire and connector as shown in the following procedures.

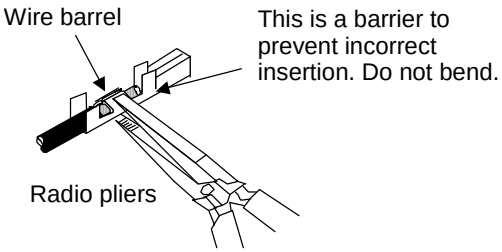
1. Carry out preparatory soldering onto the wire. (Peel 3.5mm of the sheath.)



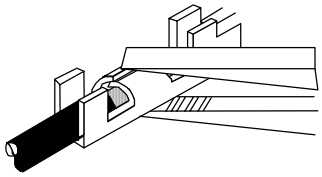
2. Insert the wire into the contact. Hold the sheath retainer.



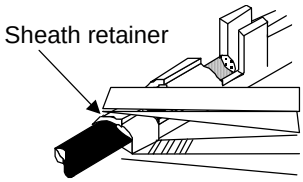
3. Lightly press down one side of the wire barrel using radio pliers.



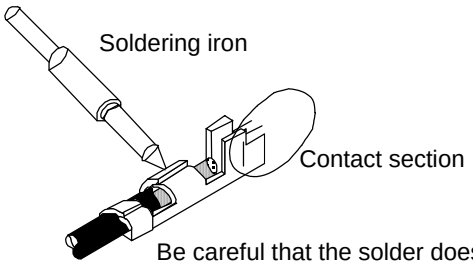
4. Firmly press down the other side of the wire barrel. (Press firmly enough that the wire will not come out when pulled lightly.)



5. Firmly press down the sheath retainer in the same manner as the wire barrel.

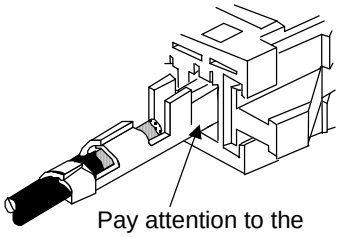


6. Apply the soldering iron, and melt the preparatory solder inside. (Better results will be achieved if an additional, small amount of solder is applied.)



Be careful that the solder does not flow into the contact section.

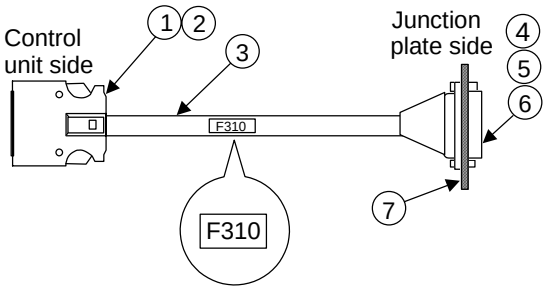
7. Lastly, insert the soldered contact with wire into the housing.



Appendix 7.1 F310 Cable Manufacturing Drawing

Application : Control unit - serial device connection
(Cable from control unit to junction plate.)

Assembly drawing



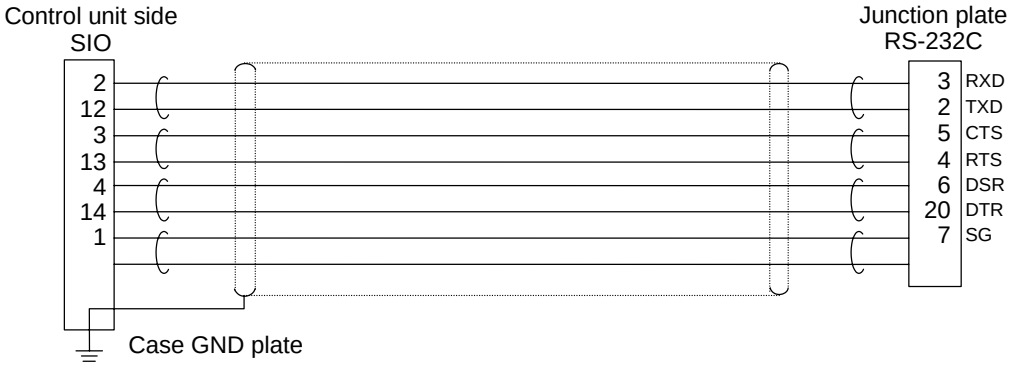
Note (3)

List of parts used

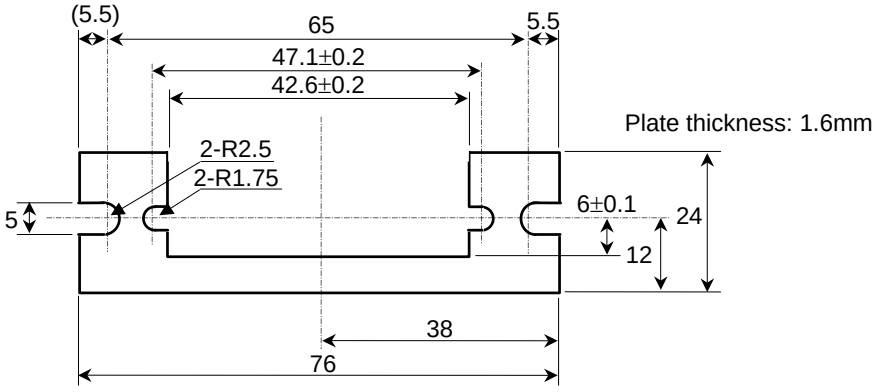
No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 6P	**Note (1)**	(1)
4	Connector CDB-25S	Hirose Electric	1
5	Contact CD-SC-111	Hirose Electric	7
6	Lock nut HD-LNA	Hirose Electric	2
7	F installation plate N750D714H01	Mitsubishi Electric (Refer to dimension drawing)	1

Connection diagram

Maximum cable length: 8m **Note (4)**



F installation plate outline dimensions drawing



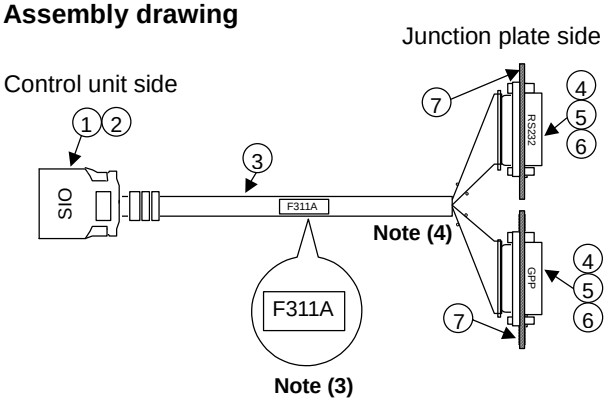
Manufacturing precautions

(1) The wire material shall be a shielded, 6-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) The total length of the cable, including the length from this cable to the cable connected to the RS-232C device, must be 15m or less.

Appendix 7.2 F311 Cable Manufacturing Drawing

Application : Control unit - serial device connection
(Cable from control unit to junction plate.)

Assembly drawing

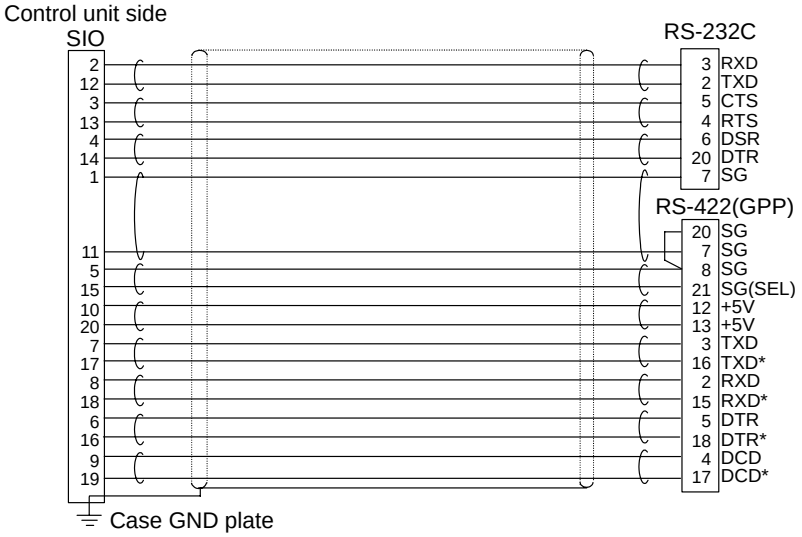


List of parts used

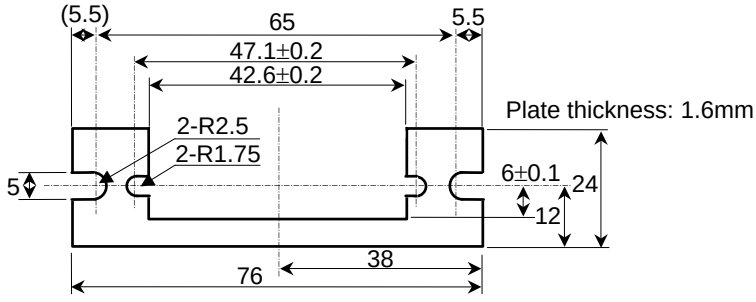
No.	Part name/type	Maker	Q'ty
1	Connector 10120-6000VE	Sumitomo 3M	1
2	Connector case 10320-3210-000	Sumitomo 3M	1
3	Wire material UL20276 AWG28 × 10P	**Note (1)**	(1)
4	Connector CDB-25S	Hirose Electric	2
5	Contact CD-SC-111	Hirose Electric	21
6	Lock nut HD-LNA	Hirose Electric	4
7	F installation plate N750D714H01	Mitsubishi Electric (Refer to dimension drawing)	2

Maximum cable length: 8m **(Note 5)**

Connection diagram



F installation plate outline dimensions drawing



Manufacturing precautions

(1) The wire material shall be a shielded, 10-pair stranded cable equivalent to UL20276 Standards AWG28 (0.08mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing. The Mitsubishi-supplied cable is labeled "F311A" due to a change of its connection.
(4) Provide a protective cover from the exposed part of the branching section wire to the connector, and fix with a bundling band.
(5) The total length of the cable, including the length from this cable to the cable connected to the RS-232C device, must be 15m or less.

Appendix 7.3 F320 Cable Manufacturing Drawing

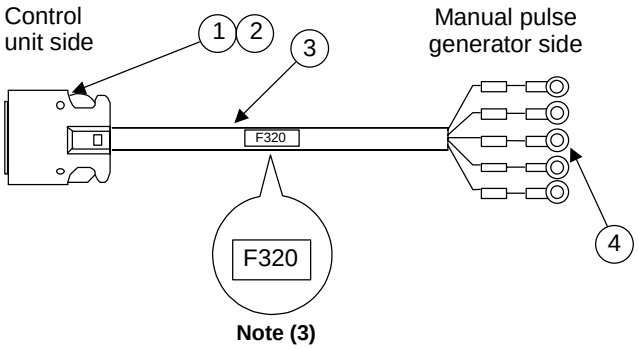
Application :

Control unit - manual pulse generator connection
(When connecting one manual pulse generator)

Option (Compatible connector set)

FCUA-CS000 (Note that only the control unit connector is compatible)

Assembly drawing



List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 6P	**Note (1)**	(1)
4	Crimp terminal V1.25-3	J. S. T	4

Connection diagram

Maximum cable length: 30m

Manufacturing precautions

(1) The wire material shall be a shielded, 6-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) Stamp the name of each signal on the crimp terminal side mark tube and install.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

Appendix 7.4 F321 Cable Manufacturing Drawing

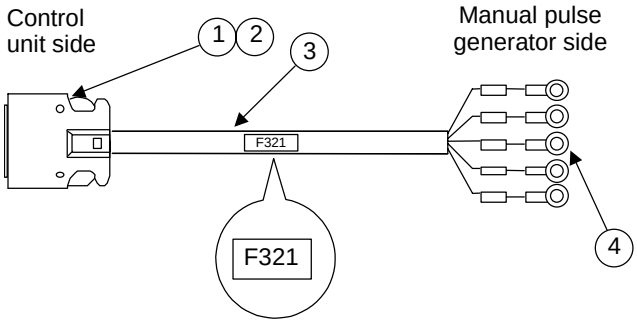
Application :

Control unit - manual pulse generator connection
(When connecting two manual pulse generators)

Option (Compatible connector set)

FCUA-CS000 (Note that only the control unit connector is compatible)

Assembly drawing

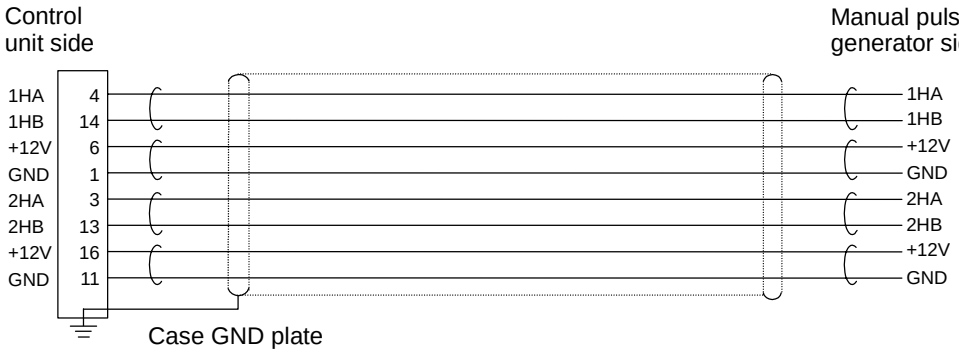


List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 6P	**Note (1)**	(1)
4	Crimp terminal V1.25-3	J. S. T	8

Connection diagram

Maximum cable length: 30m



Manufacturing precautions

(1) The wire material shall be a shielded, 6-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) Stamp the name of each signal on the crimp terminal side mark tube and install.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

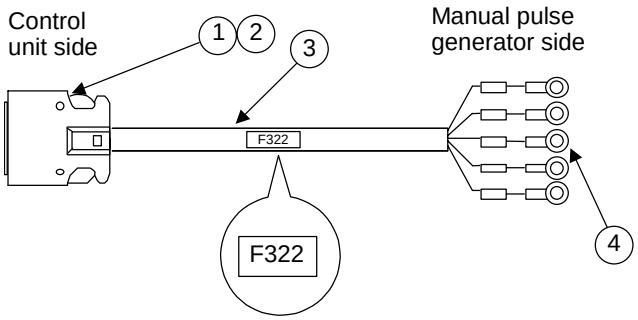
Appendix 7.5 F322 Cable Manufacturing Drawing

Application :

Control unit - manual pulse generator connection
(When connecting three manual pulse generators)

Option (Compatible connector set)
FCUA-CS000 (Note that only the control unit connector is compatible)

Assembly drawing



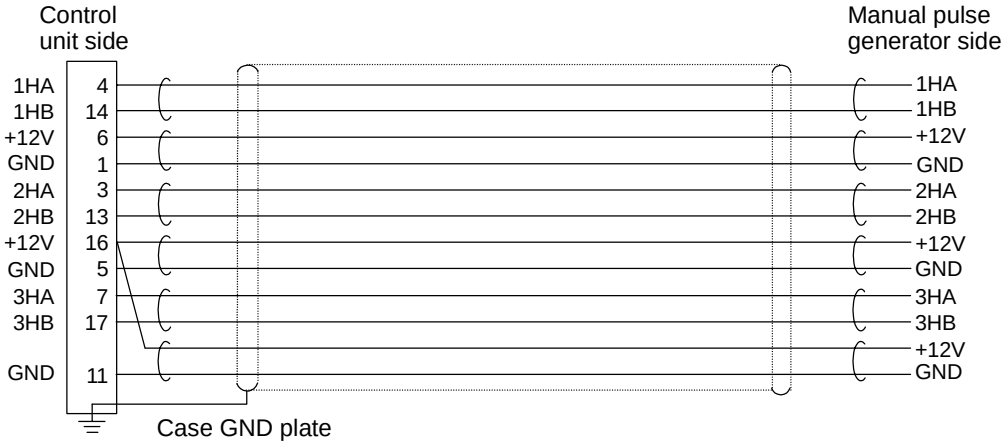
Note (3)

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 6P	**Note (1)**	(1)
4	Crimp terminal V1.25-3	J. S. T	12

Connection diagram

Maximum cable length: 30m



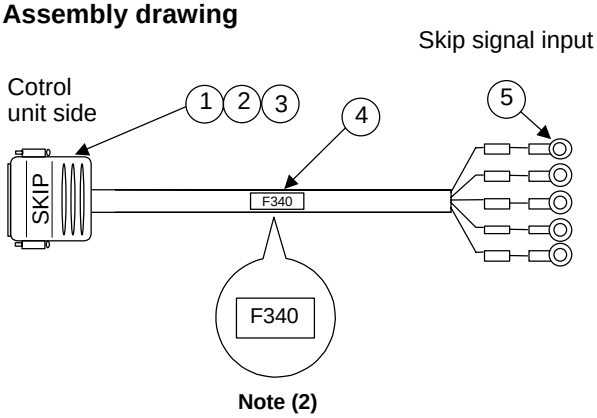
Manufacturing precautions

(1) The wire material shall be a shielded, 6-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) Stamp the name of each signal on the crimp terminal side mark tube and install.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

Appendix 7.6 F340 Cable Manufacturing Drawing

Application : External skip signal input (4 points)

Assembly drawing

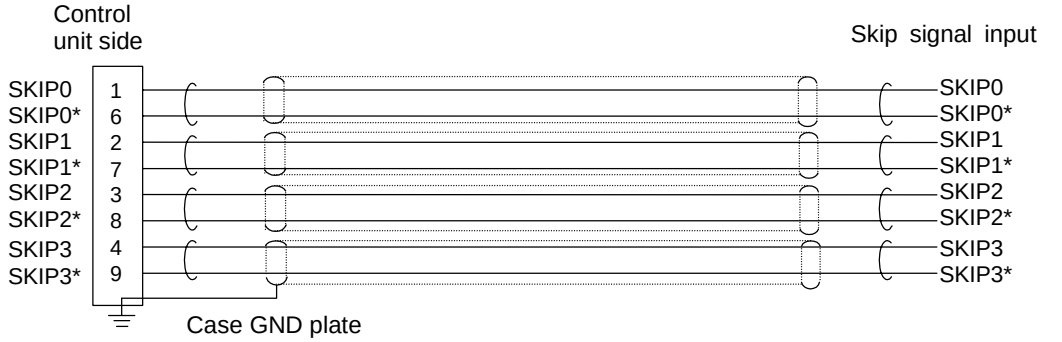


Note (2)

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector CDE-9PF	Hirose Electric	1
2	Contact CD-PC-111	Hirose Electric	8
3	Connector case HDE-CTH	Hirose Electric	1
4	Wire material B-22(19)X2SJ-1X9	Sumitomo Denko	(4)
5	Crimp terminal V1.25-4	J. S. T	8

Connection diagram



Manufacturing precautions

(1) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(2) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(3) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(4) Stamp the name of each signal on the crimp terminal side mark tube and install.
(5) Insulate the crimp terminals of unused signal wires with vinyl tape, etc.

Appendix 7.7 F350 Cable Manufacturing Drawing

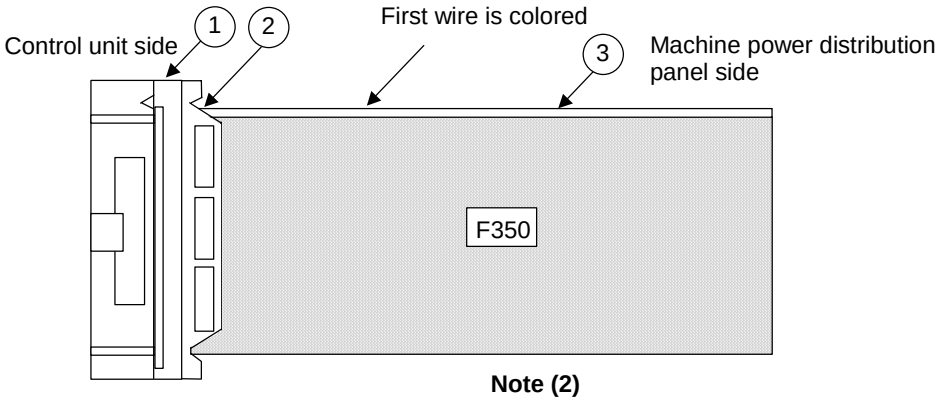
Application : Control unit - machine electric cabinet

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 7920-6500SC	Sumitomo 3M	1
2	Strain relief 3448-7920	Sumitomo 3M	1
3	Wire material B20-S	**Note (1)**	(1)

Assembly drawing

Maximum cable length: 50m



Note (2)

Manufacturing precautions

(1) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(2) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.

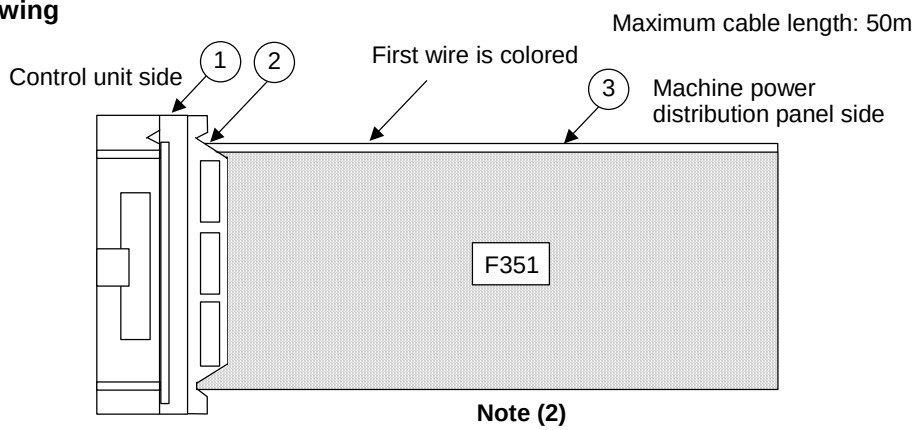
Appendix 7.8 F351 Cable Manufacturing Drawing

Application : Extension DIO - machine electric cabinet

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 7940-6500SC	Sumitomo 3M	1
2	Strain relief 3448-7940	Sumitomo 3M	1
3	Wire material B40-S	**Note (1)**	(1)

Assembly drawing



Note (2)

Manufacturing precautions

(1) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(2) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(3) The DI and DO cables are the same. Stamp DI or DO on the connector to prevent incorrect insertion.

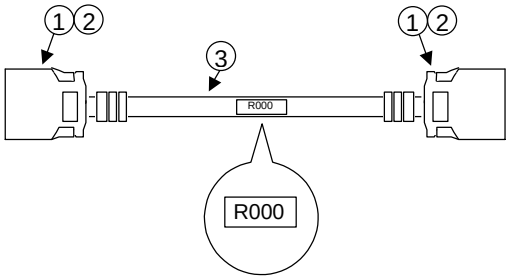
Appendix 7.9 FCUA-R000 Cable Manufacturing Drawing

Application :

Control unit – servo drive unit connection
Servo drive unit – servo drive unit connection
Control unit - communication terminal connection, etc.

Option (Compatible connector set)
FCUA-CS000

Assembly drawing



Note (3)

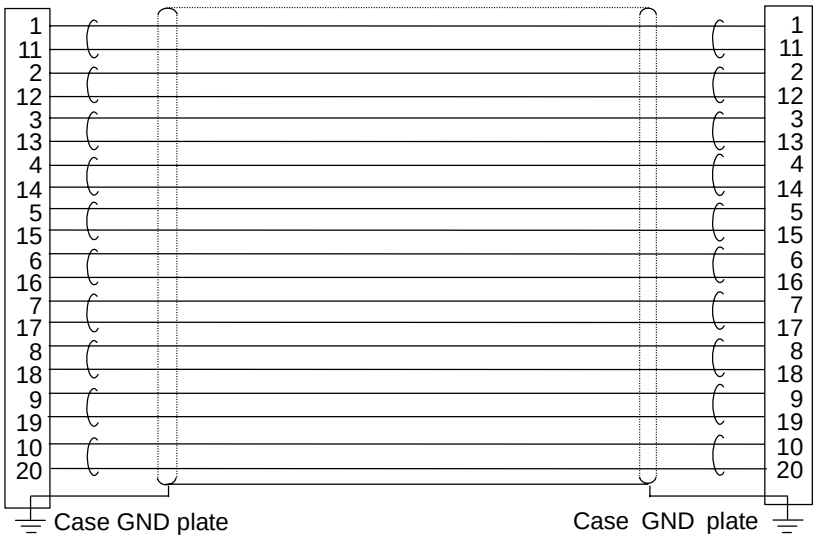
List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-6000EL	Sumitomo 3M	2
2	Connector case 10320-3210-000	Sumitomo 3M	2
3	Wire material UL20276 AWG28 × 10P	**Note (1)**	(1)

(Note) This cable is the same as SH21 cable.

Connection diagram

Maximum cable length: 30m



Manufacturing precautions

(1) The wire material shall be a shielded, 10-pair stranded cable equivalent to UL20276 Standards AWG28 (0.08mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield over the sheath, and wrap copper foil tape over it. Clamp with the connector case frame.
(5) The part 1 connector and part 2 connector case are crimp type parts. If soldered types are preferred, use the 10120-3000VE connector and 10320-52F0-008 connector case (both Sumitomo 3M).

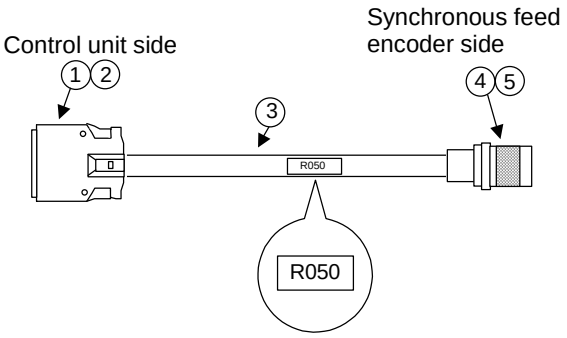
Appendix 7.10 FCUA-R050 Cable Manufacturing Drawing

Application :

Control unit - synchronous feed encoder connection (Straight type)

Option (Compatible connector set)
FCUA-CS050

Assembly drawing



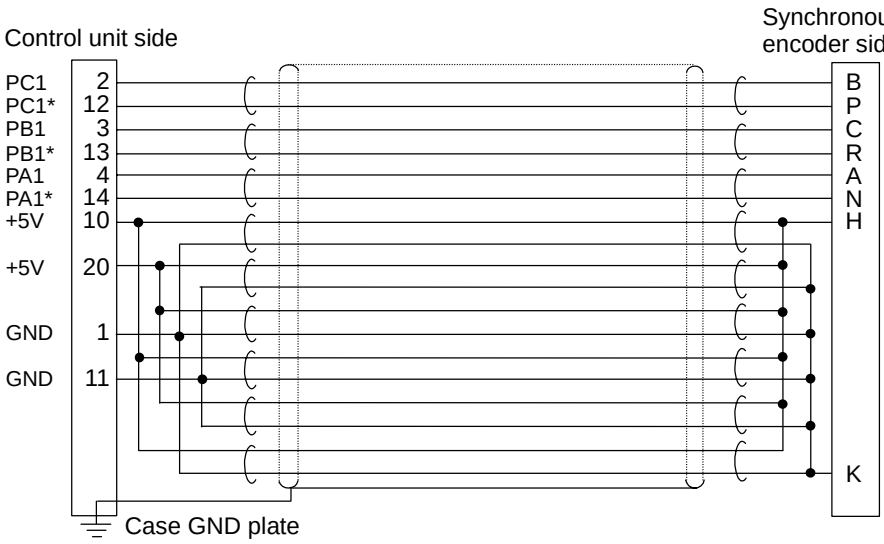
Note (3)

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 12P	**Note (1)**	(1)
4	Straight plug MS3106B20-29S	ITT Cannon	1
5	Cable clamp MS3057-12A	ITT Cannon	1

Connection diagram

Maximum cable length: 30m



Manufacturing precautions

(1) The wire material shall be a shielded, 12-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) For the batch connection treatment and shield treatment wire, use AWG24 (0.2mm^2) or equivalent.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

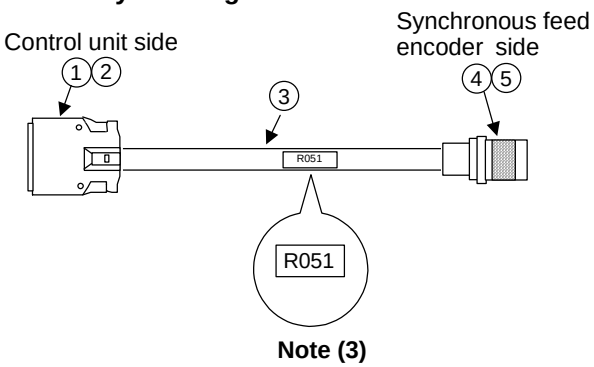
Appendix 7.11 FCUA-R051 Cable Manufacturing Drawing

Application :

Control unit - synchronous feed encoder connection (Straight type)

Option (Compatible connector set)
FCUA-CS050

Assembly drawing



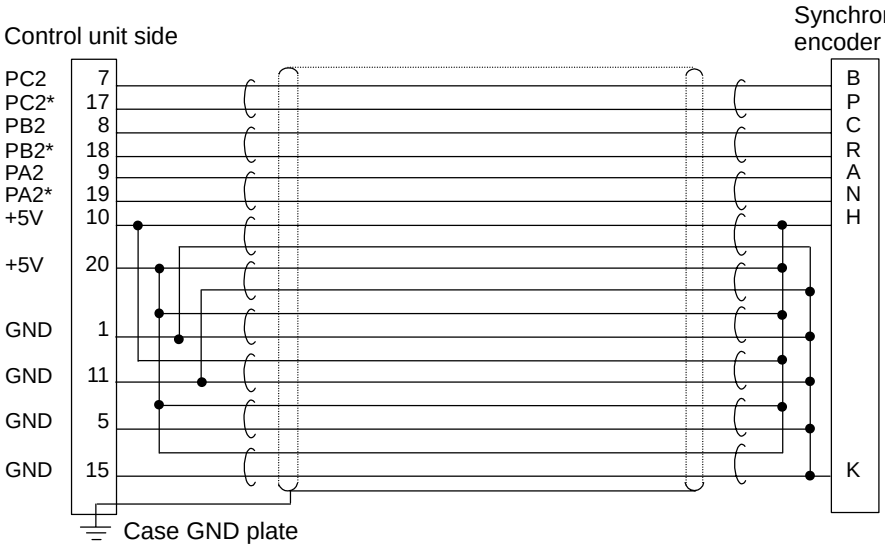
Note (3)

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 12P	**Note (1)**	(1)
4	Straight plug MS3106B20-29S	ITT Cannon	1
5	Cable clamp MS3057-12A	ITT Cannon	1

Connection diagram

Maximum cable length: 30m



Manufacturing precautions

(1) The wire material shall be a shielded, 12-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) For the batch connection treatment and shield treatment wire, use AWG24 (0.2mm^2) or equivalent.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

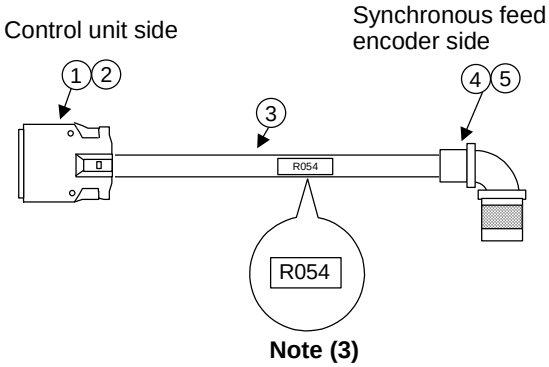
Appendix 7.12 FCUA-R054 Cable Manufacturing Drawing

Application :

Control unit - synchronous feed encoder connection (Right angle type)

Option (Compatible connector set)
FCUA-CS054

Assembly drawing



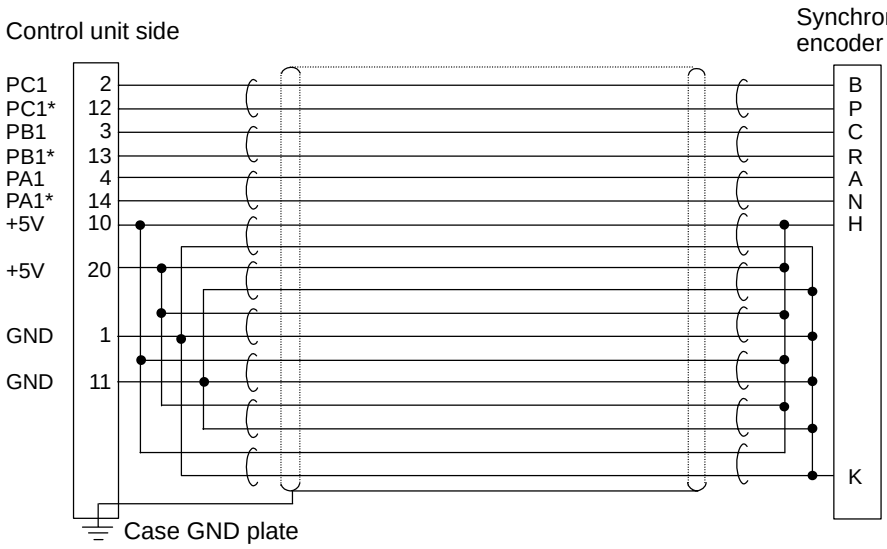
Note (3)

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 12P	**Note (1)**	(1)
4	Right angle plug MS3108B20-29S	ITT Cannon	1
5	Cable clamp MS3057-12A	ITT Cannon	1

Connection diagram

Maximum cable length: 30m



Manufacturing precautions

(1) The wire material shall be a shielded, 12-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) For the batch connection treatment and shield treatment wire, use AWG24 (0.2mm^2) or equivalent.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

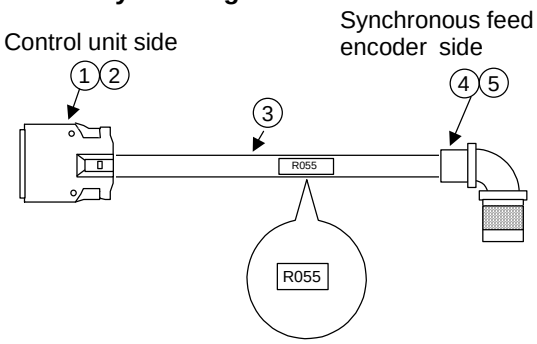
Appendix 7.13 FCUA-R055 Cable Manufacturing Drawing

Application :

Control unit - synchronous feed encoder connection (Right angle type)

Option (Compatible connector set)
FCUA-CS054

Assembly drawing



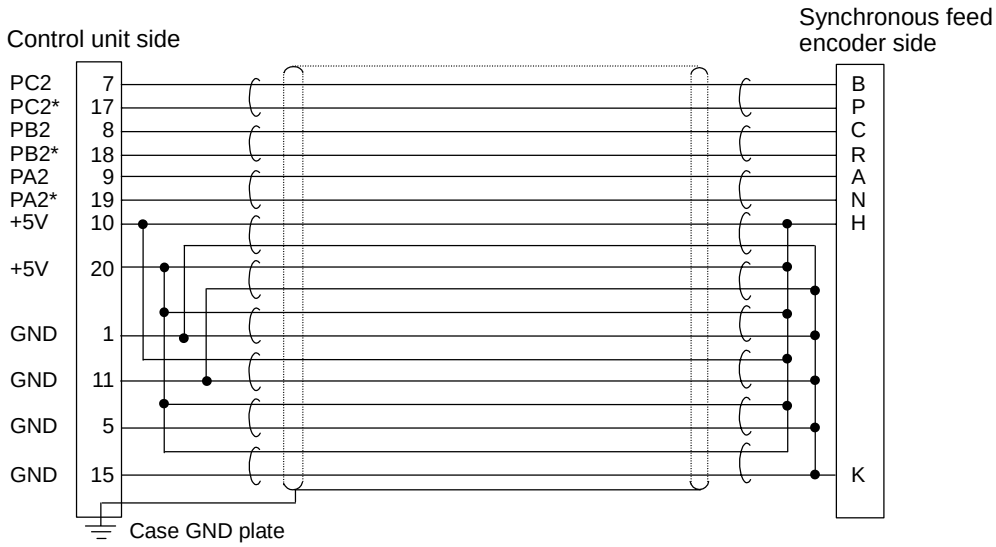
Note (3)

List of parts used

No.	Part name/type	Maker	Q'ty
1	Connector 10120-3000VE	Sumitomo 3M	1
2	Connector case 10320-52F0-008	Sumitomo 3M	1
3	Wire material UL1061-2464 AWG22 × 12P	**Note (1)**	(1)
4	Right angle plug MS3108B20-29S	ITT Cannon	1
5	Cable clamp MS3057-12A	ITT Cannon	1

Maximum cable length: 30m

Connection diagram



Manufacturing precautions

(1) The wire material shall be a shielded, 12-pair stranded cable equivalent to UL1061-2464 Standards AWG22 (0.3mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Fold the wire material shield on the control unit side over the sheath, and wrap copper foil tape over it. Connect to the connector case GND plate.
(5) For the batch connection treatment and shield treatment wire, use AWG24 (0.2mm^2) or equivalent.
(6) In the catalog specifications, the part 1 connector uses AWG24 (0.2mm^2) or less wire material, but AWG22 (0.3mm^2) can also be used.

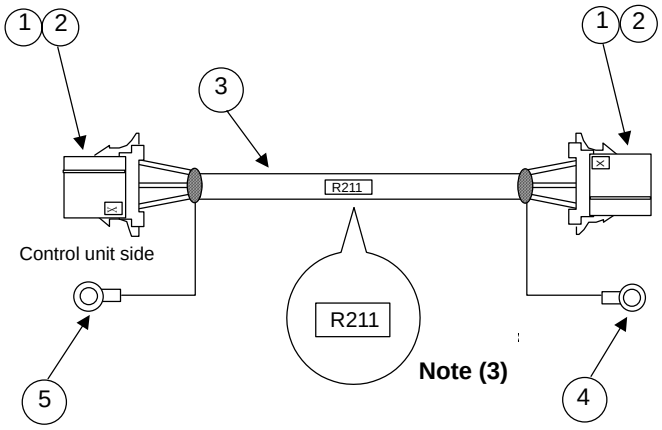
Appendix 7.14 FCUA-R211 Cable Manufacturing Drawing

Application:

Control unit – remote I/O unit connection
Remote I/O unit – remote I/O unit connection
Remote I/O unit – communication terminal connection

Option (Compatible connector set)
FCUA-CN211
(Note that when a one end connector and contact are used, there is no crimp terminal)

Assembly drawing

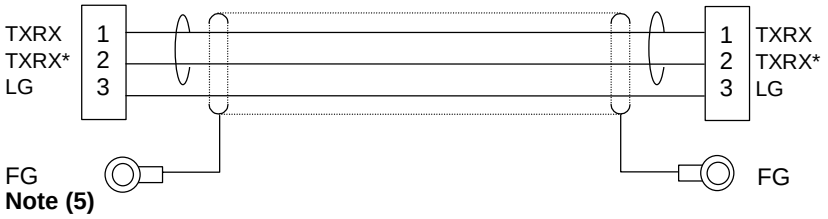


List of parts used

No.	Part name/type	Maker	Qty.
1	Connector 1-178288-3	Tyco Electronics AMP	2
2	Contact 1-175218-2	Tyco Electronics AMP	6
3	Wire material MIX3CHRV-SV-SB Twisted pair cable with compound 3-pair shield. **Note (1)**	TOA Electric Industry	(1)
4	Crimp terminal V1.25-3	J. S. T	1
5	Crimp terminal V1.25-5	J. S. T	1

Connection diagram

Maximum cable length: 50m



Manufacturing precautions

(1) The wire material shall be a shielded 3-pair stranded pair cable equivalent to AWG20 (0.5mm^2).
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Install each crimp terminal side after stamping the name of each signal on the mark tube.
(5) Protect both ends of the wire material with insulation bushing.
(6) Use AWG18 (0.75mm^2) or equivalent for the shield treatment wire material.
(7) Ground the crimp terminal connected to the shield to the control unit or communication terminal frame ground.
Note that there may be cases where only one end is connected, both ends are connected, or neither end is connected to improve the noise resistance,.

Appendix 7.15 FCUA-R220 Cable Manufacturing Drawing

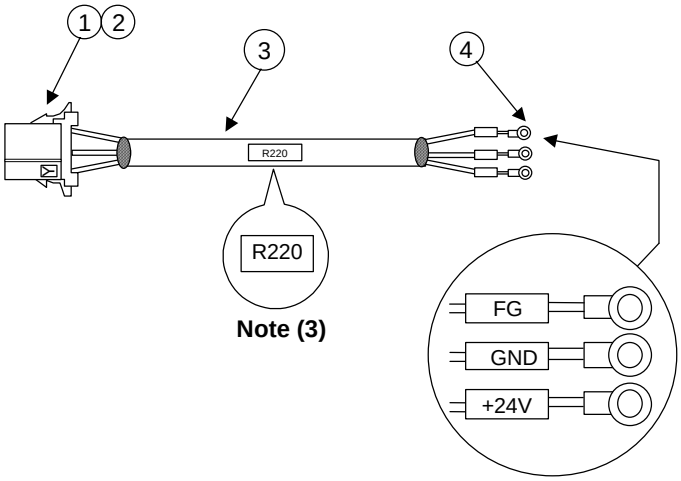
Application:

Supply of 24V to control unit,
remote I/O unit and communication terminal

Option (Compatible connector set)

FCUA-CN220
(Note that this corresponds only to the connector on the control unit side.)

Assembly drawing

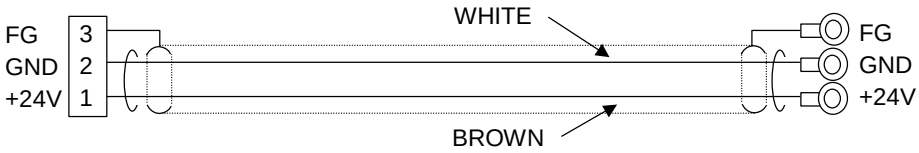


List of parts used

No.	Part name/model	Maker	Q'ty
1	Connector 2-178288-3	Tyco Electronics AMP	1
2	Contact 1-175218-5	Tyco Electronics AMP	3
3	Wire material JPVV-SB 1P × 0.5mm^2	BANDO Electric Industry **Note (1)**	(1)
4	Crimp terminal V1.25-3	J. S. T	3

Connection diagram

Maximum cable length: 30m



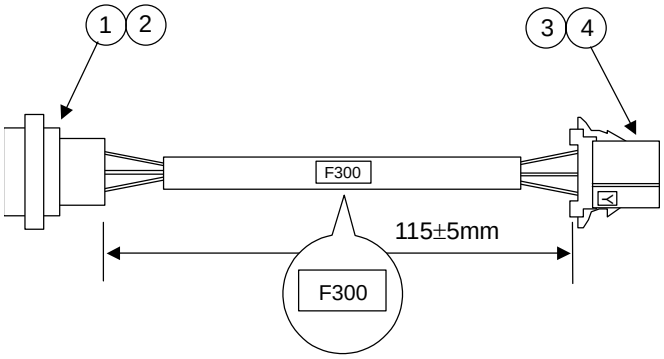
Manufacturing precautions

(1) The wire material shall be a shielded 1-pair stranded cable equivalent to AWG20 (0.5mm^2). If the cable is 10m or longer, select AWG16 (1.25mm^2) material or equivalent.
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.
(4) Install each crimp terminal side after stamping the name of each signal on the mark tube.
(5) Protect both ends of the wire material with insulation bushing.
(6) Use AWG18 (0.75mm^2) or equivalent for the shield treatment wire material.

Appendix 7.16 F300 Cable Manufacturing Drawing

Application : Main card in control unit – front panel internal connection

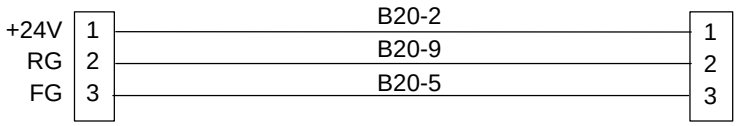
Assembly drawing



List of parts used

No.	Part name/model	Maker	Q'ty
1	Connector 2-177648-3	Tyco Electronics AMP	1
2	Contact 1-175289-5	Tyco Electronics AMP	3
3	Connector 2-178288-3	Tyco Electronics AMP	1
4	Contact 1-175218-5	Tyco Electronics AMP	3

Connection diagram



Manufacturing precautions

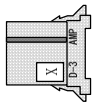
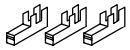
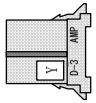
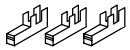
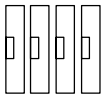
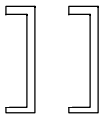
(1) The wire material shall be AWG20 (0.5mm^2) or equivalent.
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.

APPENDIX 8 LIST OF CONNECTOR SETS

The procurement type is FCUA-CS/CN□□□.

Connector type	Application	Package contents			
CS000	Control unit - CT100 Control unit - C1 C1-C1	Connector (3M) 10120-3000VE × 2 pcs.	Connector case (3M) 10320-52F0-008 × 2 pcs.		Connector case (HIROSE) HDB-CTF × 1 pc.
CS020	Control unit - General-purpose RS-232C device	Connector (3M) 10120-3000VE × 1 pc.	Connector case (3M) 10320-52F0-008 × 1 pc.	Connector (HIROSE) HDBB-25PF (05) × 1 pc.	Cover (Japan Aviation Electronics) DB20962 × 1 pc.
CS021	Control unit - RS-232-C device for relay	Connector (3M) 10120-3000VE × 1 pc. Lock nut (Japan Aviation Electronics) D20418-J3 × 2 pcs.	Connector case (3M) 10320-52F0-008 × 1 pc. F installation plate (MITSUBISHI) N750D137H01	Connector (Japan Aviation Electronics) DB-25SF-N × 1 pc.	
CS050	Control unit - Synchronous encoder	Connector (3M) 10120-3000VE × 1 pc.	Connector (3M) 10320-52F0-008 × 1 pc.	Clamp (ITT CANON) MS0357-12A × 1 pc.	Straight (ITT CANON) MS3106B20-29S × 1 pc.
CS054	Control unit - Synchronous encoder	Connector (3M) 10120-3000VE × 1 pc.	Connector (3M) 10320-52F0-008 × 1 pc.	Clamp (ITT CANON) NS3057-12A × 1 pc.	Right angle (ITT CANON) MS3108B20-29S × 1 pc.

The procurement type is FCUA-CS/CN□□□.

Connector type	Application	Package contents			
CN211	IO communication connector	Connector (Tyco Electronics AMP) 1-178288-3 × 1 pc. 	Gold contact (Tyco Electronics AMP) 1-175218-2 × 3 pcs. 		
CN220	24VDC power supply connector	Connector (Tyco Electronics AMP) 2-178288-3 × 1 pc. 	Tin contact (Tyco Electronics AMP) 1-175218-5 × 3 pcs. 		
CN300	Remote I/O unit	Connector (3M) 7940-6500SC × 2 pcs. 			
CN301	Remote I/O unit - terminal block	Connector (3M) 7940-6500SC × 4 pcs. 	Strain relief (3M) 3448-7940 × 2 pcs. 		

APPENDIX 9 EMC INSTALLATION GUIDELINES

The pages related to the C6/C64 excerpted from the "EMC Installation Guidelines BNP-B2230" are provided in this section.
Refer to the "EMC Installation Guidelines [BNP-B8582-45]" for details on the drive section (servo drive unit/spindle drive unit).

Appendix 9.1 Introduction

EMC Directives became mandatory as of January 1, 1996. The target products must have a CE mark attached indicating that the product complies with the Directives.
As the NC unit is a component designed to control machine tools, it is believed that it is not a direct EMC Directive subject. However, we would like to introduce the following measure plans to back up EMC Directive compliance of the machine tool as the NC unit is a major component of the machine tools.

(1) Methods of installation in control/operation panel
(2) Methods of wiring cables to outside of panel
(3) Introduction of members for measures

Mitsubishi is carrying out tests to confirm the compliance to the EMC Directives under the environment described in this manual. However, the level of the noise will differ according to the equipment type and layout, control panel structure and wiring lead-in, etc. Thus, we ask that the final noise level be confirmed by the machine manufacturer.

Appendix 9.2 EMC Directives

The EMC Directives largely regulate the following two items.

- Emission ..... Capacity to prevent output of obstructive noise that adversely affects external devices.
- Immunity ..... Capacity not to malfunction due to obstructive noise from external source.

The details of each level are classified below in Table 1.
It is assumed that the Standards and test details required for a machine tool are the same as these.

Class	Name	Details	EMC	Standard
Emission	Radiated noise	Restriction of electromagnetic noise radiated through the air	EN50081-2 EN61800-3 (Industrial environment)	EN55011 (CLASS:A)
	Conductive noise	Restriction of electromagnetic noise discharged from power supply line		
Immunity	Static electricity electrical discharge	Example) Regulation of withstand level of static electricity accumulated in human body	EN50082-2 EN61800-3 (Industrial environment)	IEC61000-4-2
	Radiation immunity	Simulation of immunity from digital wireless telephones		IEC61000-4-3
	Burst immunity	Example) Regulation of withstand level of noise from relay or live wire being inserted or removed		IEC61000-4-4
	Conductive immunity	Example) Regulation of withstand level of noise flowed from power supply wires, etc.		IEC61000-4-6
	Power supply frequency magnetic field	Example) Regulation of electromagnetic noise of 50/60Hz power supply frequency		IEC61000-4-8
	Power supply dip (fluctuation)	Example) Regulation of power voltage drop withstand level		IEC61000-4-11
	Surge	Example) Regulation of withstand level of noise caused by lightning		IEC61000-4-5

Appendix 9.3 EMC Countermeasures

The main items relating to EMC countermeasures include the following.

(1) Store the device in a sealed metal panel.
(2) Ground all conductors that are floating electrically. Decrease the impedance.
(3) Increase the distance between the drive line and signal wire.
(4) Shield the cables wired outside of the panel.
(5) Install a noise filter.

Take care the following items to suppress the noise radiated outside of the panel.

(1) Accurately ground the devices.
(2) Use shielded cables.
(3) Increase the electrical seal of the panel. Reduce the gaps and holes.

Appendix 9.4 Panel Structure

The design of the panel is a very important factor for the EMC countermeasures, so take the following countermeasures into consideration.

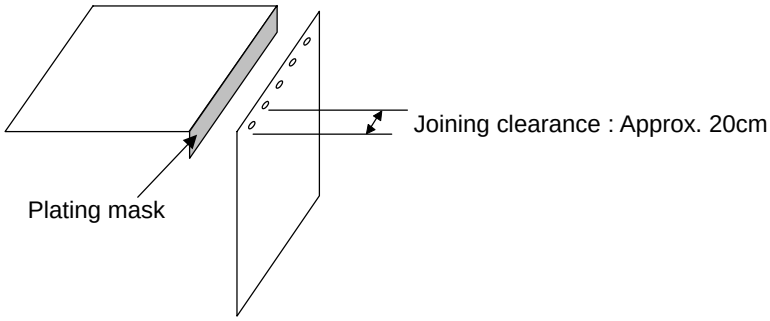
Appendix 9.4.1 Countermeasures for control panel body

(1) Use metal for all members configuring the panel.

(2) When joining the top plate and side plates, etc., treat the welded or contacting sections so that the impedance is reduced, and then fix with screws.

[CAUTION]

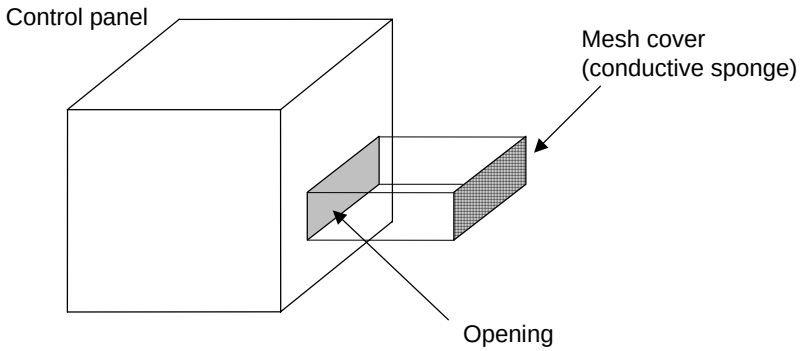
- Using screws to fix the plates that have been painted is the same as an insulated state. Peel off the paint and fix the screws.



(3) Note that if the plate warps due to the screw fixing, etc., by that creating a clearance, noise could leak from that place.

(4) Plate (nickel, tin) the metal plate surface at the grounding plate, and connect the connections with a low impedance.

(5) If there is a large opening, such as ventilation holes, make sure to close the hole.

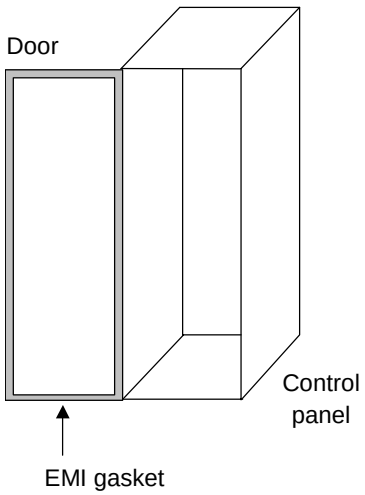


Appendix 9.4.2 Countermeasures for door

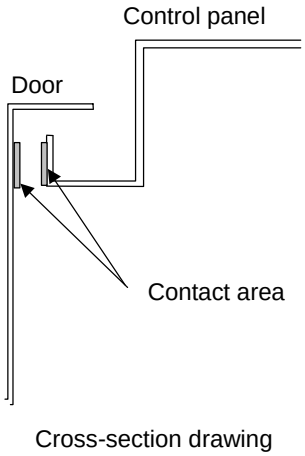
(1) Use metal for all members configuring the door.

(2) When joining the door, use a gasket to lower the impedance of the contacting sections, or use a structure with a large contact area as shown below.

a) Use of gasket



b) Large contact area



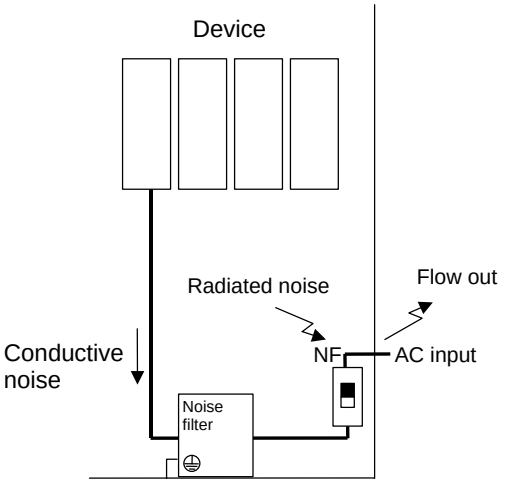
(3) The EMI gasket or conductive packing must contact the metal surface uniformly and at the correct position.

[CAUTION]

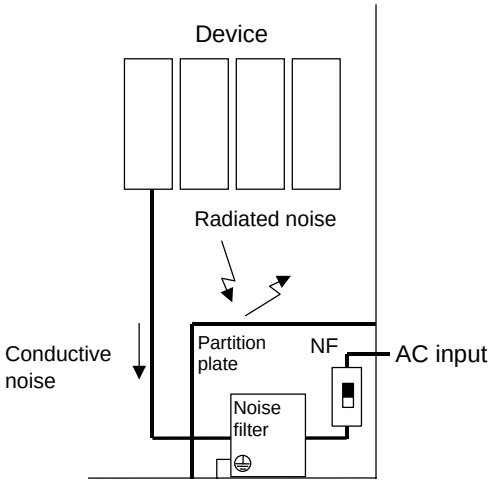
- When not using a gasket, ground the control panel grounding with a grounding wire to lower the door's impedance.
- Using screws to fix the plates that have been painted (attachment of packing) is the same as an insulated state. Peel off the paint and fix the screws.

Appendix 9.4.3 Countermeasures for power supply

(1) Shield the power supply section and insert a filter to prevent the noise from flowing in or out.
Selection of the noise filter capacity will differ according to the drive amplifier and devices being used.
Refer to the "EMC Installation Guidelines" NC Servo Amplifier Section [BNP-B8582-45].



(Fig.1)



(Fig.2)

[CAUTION]

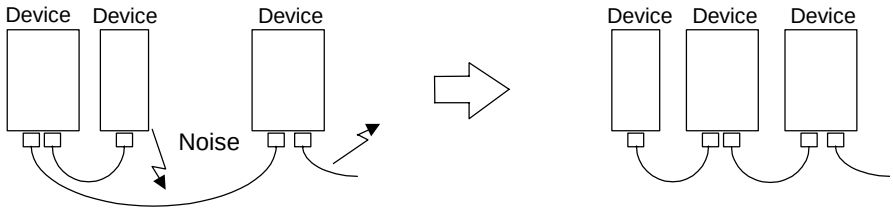
- The conductive noise can be suppressed just by inserting a noise filter, but the radiated noise will flow out. (Fig. 1)
- The conductive and radiated noise can both be suppressed by adding a partition plate to the noise filter. (Fig. 2)

Appendix 9.5 Countermeasures for Wiring in Panel

Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated. The following countermeasures must be sufficiently considered for the cables (FCUA-R000 /FCUA-R211) that carry out high-speed communication.

Appendix 9.5.1 Precautions for wiring in panel

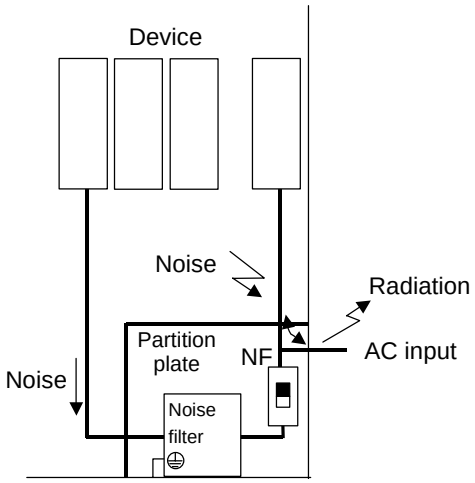
(1) If the cables are led unnecessary in the panel, they will pick up noise. Thus, keep the wiring length as short as possible.



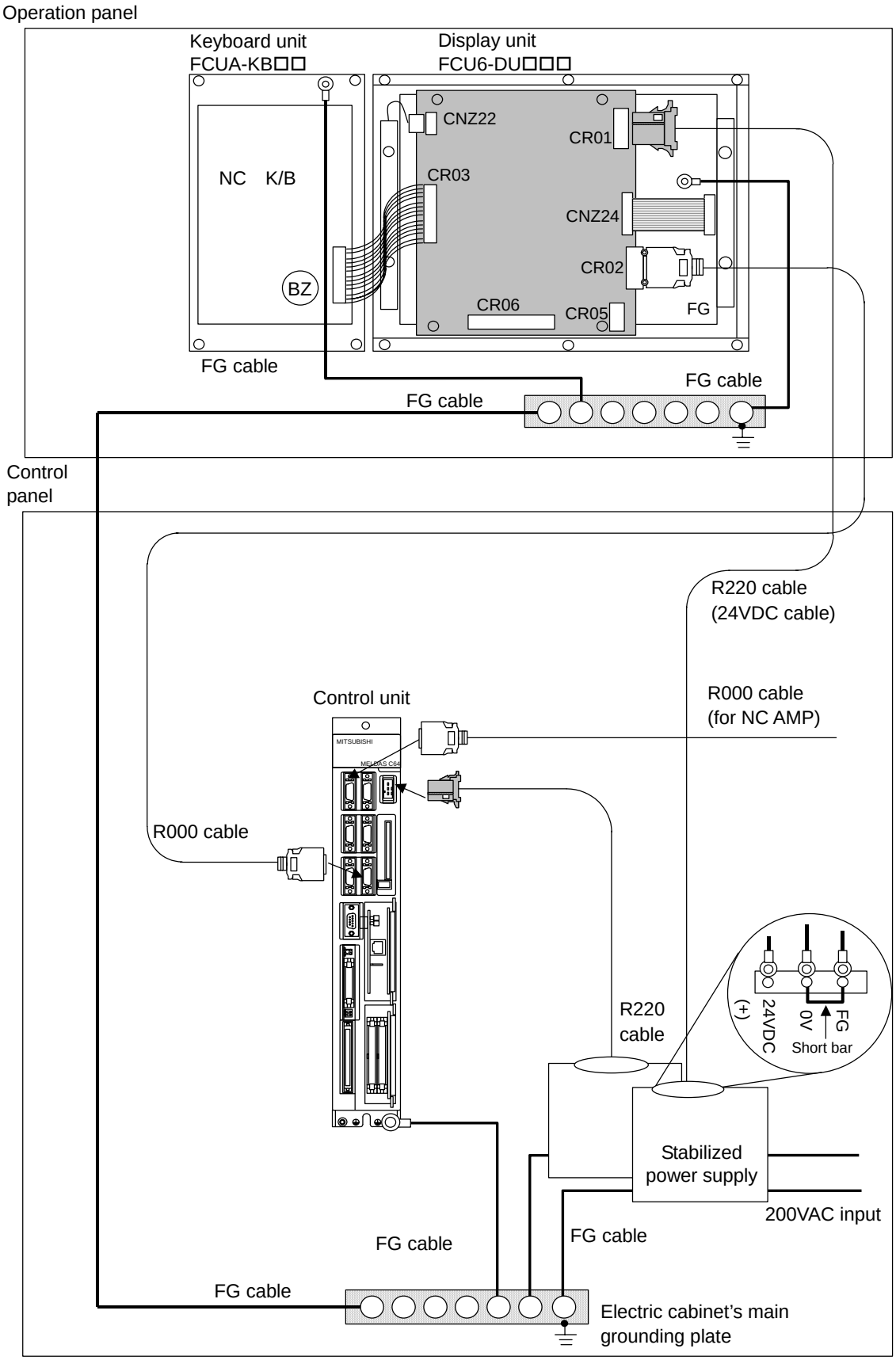
(2) Always connect the grounding wire to the FG terminal indicated on the device.

(3) Keep the distance between the drive line and encoder cable to the drive section motor as far apart as possible when wiring.

(4) Do not lead the drive line around the panel without using a filter.



Appendix 9.5.2 NC Unit grounding wire

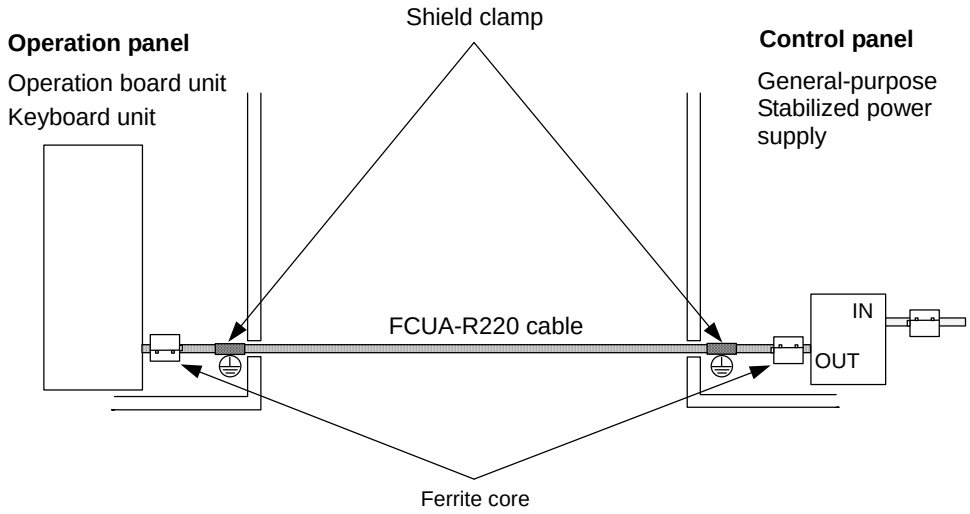


Appendix 9.5.3 Shield treatment of cables

Use shielded cables for the cables wired outside the panel in the C6/C64 Series.
Use a shield clamp (refer to 9.6.1) within 10cm of the lead-out port from the panel.

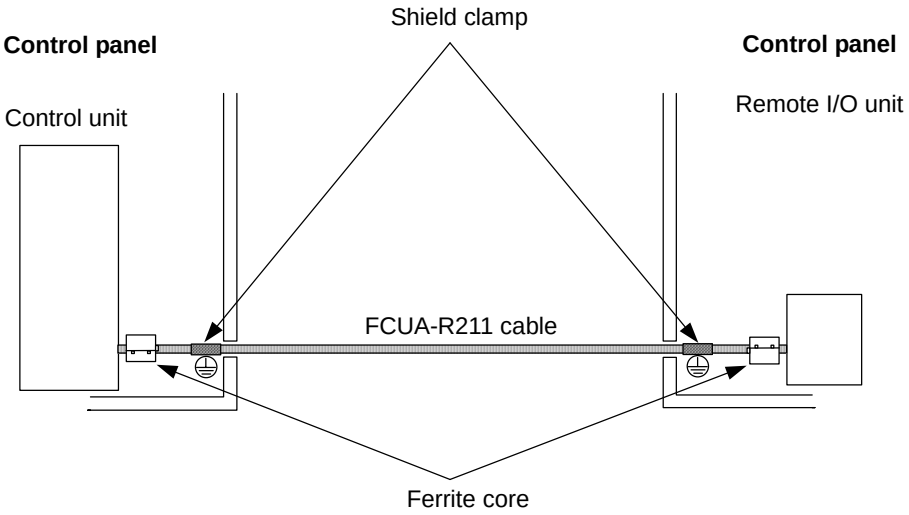
(1) DC power supply cable [FCUA-R220 cable]

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- Always install a ferrite core (refer to 9.6.2) on the stabilized power supply.
  (The ferrite core may not be required depending on the selected power supply.)



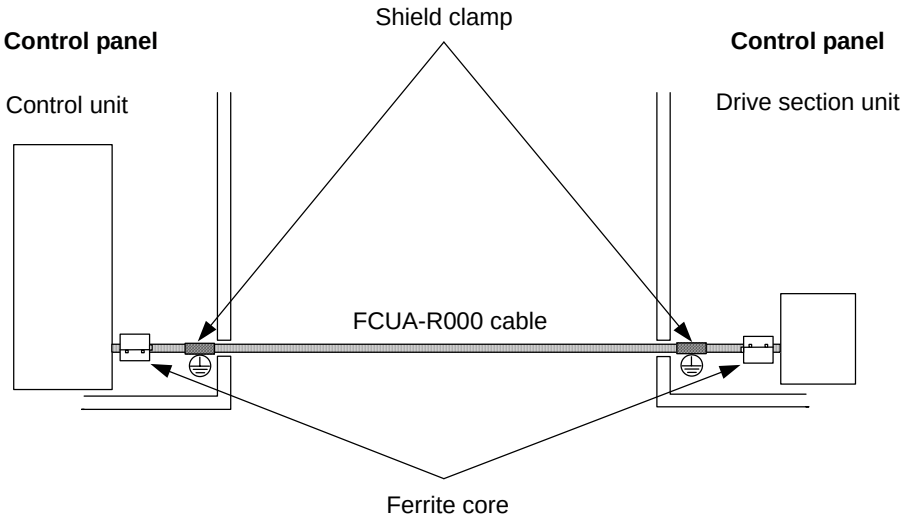
(2) Remote I/O cable [FCUA-R211 cable]

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- The shield clamp and ferrite core are not required if the control unit and base I/O unit are wired in the same panel.



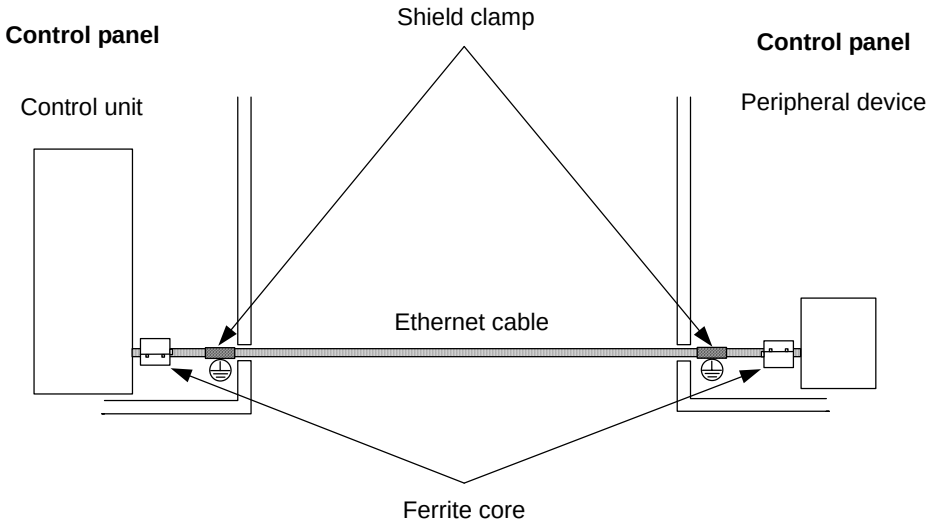
(3) Servo communication cable [FCUA-R000 cable]

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- The shield clamp and ferrite core are not required if the control unit and drive section unit are wired in the same panel.



(4) Ethernet cable

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- The shield clamp and ferrite core may not be required depending on the peripheral device.



Appendix 9.6 Parts for EMC Countermeasures

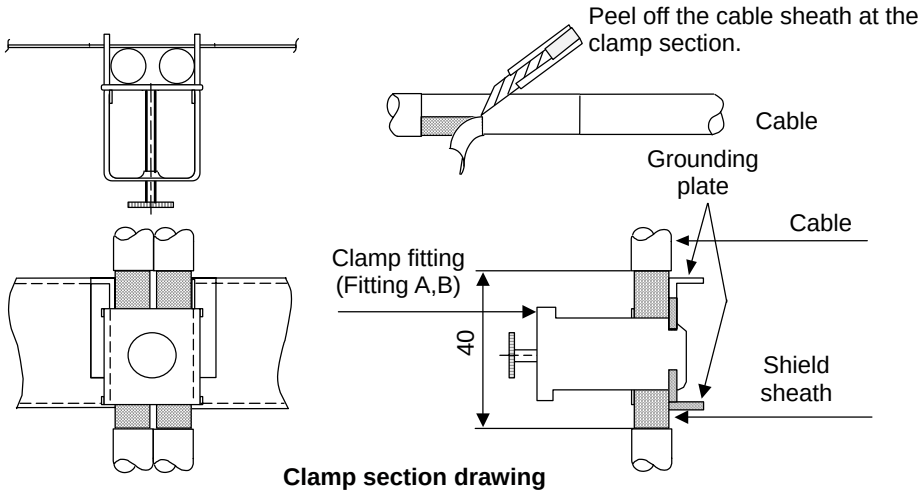
Appendix 9.6.1 Shield clamp fitting

The effect can be enhanced by directly connecting the outer sheath of the cable to the grounding plate as shown below.

Install the grounding plate near the outlet (within 10cm) of each panel, and press against the grounding plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together.

To provide sufficient frame grounding, install the grounding plate directly on the cabinet or connect with a grounding wire.

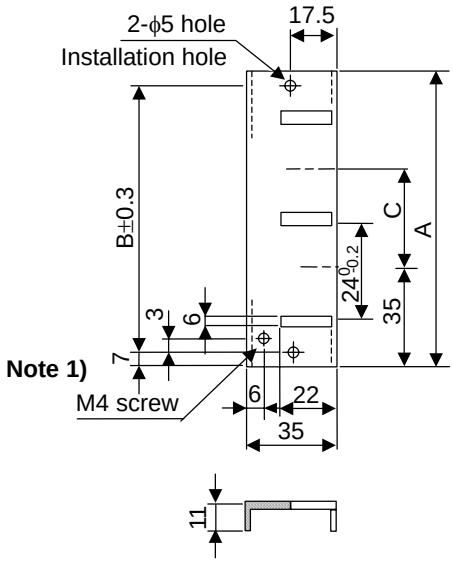
If the grounding plate and clamp fitting set AERSBAN-□SET is required, please contact Mitsubishi.



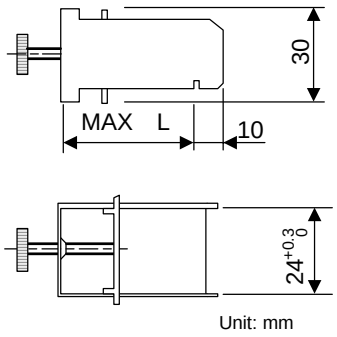
Clamp section drawing

Outline drawing

Grounding plate



Clamp fitting



Unit: mm

Note 1) Screw hole for wiring to cabinet's grounding plate.
Note 2) The grounding plate thickness is 1.6mm.

	A	B	C	Enclosed fitting
AERSBAN-DSET	100	86	30	Two A clamp fittings
AERSBAN-ESET	70	56	–	One B clamp fitting

	L
A clamp fitting	70
B clamp fitting	45

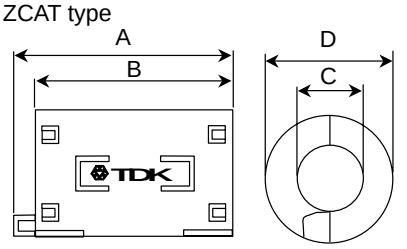
Appendix 9.6.2 Ferrite core

The ferrite core is mounted integrally with the plastic case.
This can be installed with one touch without cutting the interface cable or power supply cable.
This ferrite core is effective against common mode noise, allowing countermeasures against noise without affecting the quality of the signal.

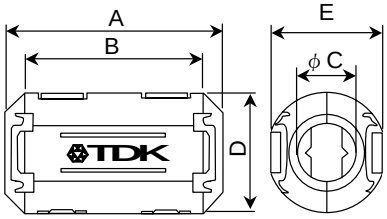
Recommended ferrite core

TDK ZCAT Series
ZCAT3035-1330 (-BK)

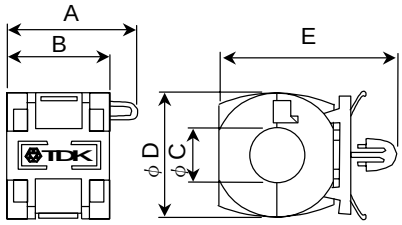
ZCAT type



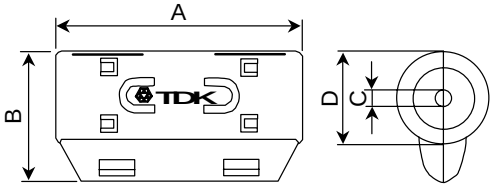
ZCAT-A,ZCAT-AP type



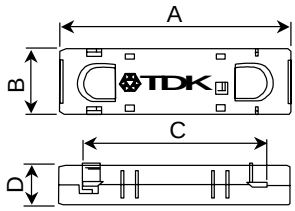
ZCAT-B type



ZCAT-C type



ZCAT-D type



Applicable cable thickness: 1.3mm max.

Part Name	A	B	øc	ød	E	Applicable cable outer diameter	Weight (g)
ZCAT1518-0730-M (-BK) *1	22±1	18±1	7±1	15±1	–	7max.	6
ZCAT1518-0730 (BK) *2	22±1	18±1	7±1	15±1	–	7max.	6
ZCAT2017-0930-M (-BK)	21±1	17±1	9±1	20±1	–	9max.	11
ZCAT2032-0930-M (-BK) *1	36±1	32±1	9±1	19.5±1	–	9max.	22
ZCAT2032-0930 (-BK) *2	36±1	32±1	9±1	19.5±1	–	9max.	22
ZCAT2132-1130-M (-BK) *1	36±1	32±1	11±1	20.5±1	–	11max.	22
ZCAT2132-1130 (-BK) *2	36±1	32±1	11±1	20.5±1	–	11max.	22
ZCAT3035-1330-M (-BK) *1	39±1	34±1	13±1	30±1	–	13max.	63
ZCAT3035-1330 (-BK) *2	39±1	34±1	13±1	30±1	–	13max.	63
ZCAT1525-0430AP-M (-BK)	25±1	20±1	4±1	15±1	11.5±1	2.5 to 4 (USB)	7
ZCAT1325-0530A-M (-BK) *1	25±1	20±1	5±1	12.8±1	11.2±1	3~5 (USB)	7
ZCAT1325-0530A (-BK)	25±1	20±1	5±1	12.8±1	11.2±1	3~5 (USB)	7
ZCAT1730-0730A-M (-BK)	30±1	23±1	7±1	16.5±1	15±1	4~7 (USB/IEE1394)	12
ZCAT2035-0930A-M (-BK) *1	35±1	28±1	9±1	19.5±1	17.4±1	6~9	22
ZCAT2035-0930A (-BK)	35±1	28±1	9±1	19.5±1	17.4±1	6~9	22
ZCAT2235-1030A-M (-BK)	35±1	28±1	10±1	21.5±1	20±1	8~10	27
ZCAT2436-1330A-M (-BK)	36±1	29±1	13±1	23.5±1	22±1	10~13	29
ZCAT2017-0930B-M (-BK)	21±1	17±1	9±1	20±1	28.5±1	9max.	12
ZCAT2749-0430-M (-BK)	49±1	27±1	4.5±1	19.5±1	–	4.5max.	26
ZCAT4625-3430D (-BK)	45.5±1	24.5±1	34±1	12±1	–	For 26-core flat cable	32
ZCAT4625-3430DT (-BK)*3	45.5±1	24.5±1	34±1	12±1	–	For 26-core flat cable	32
ZCAT6819-5230D (-BK)	67.5±1	18.5±1	52±1	16±1	–	For 40-core flat cable	58
ZCAT6819-5230DT (-BK)*3	67.5±1	18.5±1	52±1	17±1	–	For 40-core flat cable	58

ZCAT-C type, ZCAT-D type
*1. The M stamp is attached.
*2. A fixing band is attached at shipment.
*3. Specifications for fixing with double-sided tape. (Tape attached when shipped from factory.)

●ZCAT-B type: Cabinet fixing type installation hole ø4.8 to 4.9mm, plate thickness 0.5 to 2mm

●ZCAT-AP, ZCAT-C types: Structure that prevents easy opening after case is closed.

Appendix 9.6.3 Surge protector

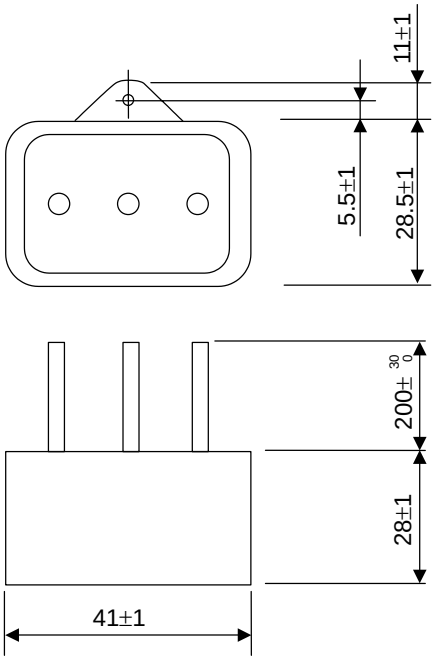
(1) Surge absorber

Make sure that surge does not directly enter the AC line of the general-purpose stabilized power supply (prepared by user) supplied to the control unit and DIO. The following product or equivalent is recommended for the surge killer.

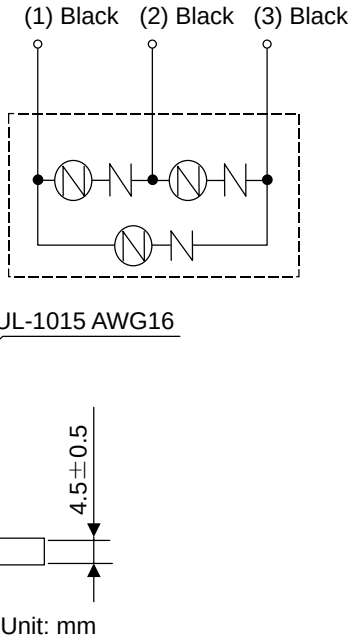
(1) Part name : RAV-781BYZ-2
Manufacturer : Okatani Denki Sangyo

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V ± 10%	Surge resistance level 8/20μs	Surge withstand voltage 1.2/50μs	Static capacity	Working temperature range
250V 3ø	300V	783V	2500A	20kV	75pF	–20°C to +70°C

Outline drawing



Circuit drawing

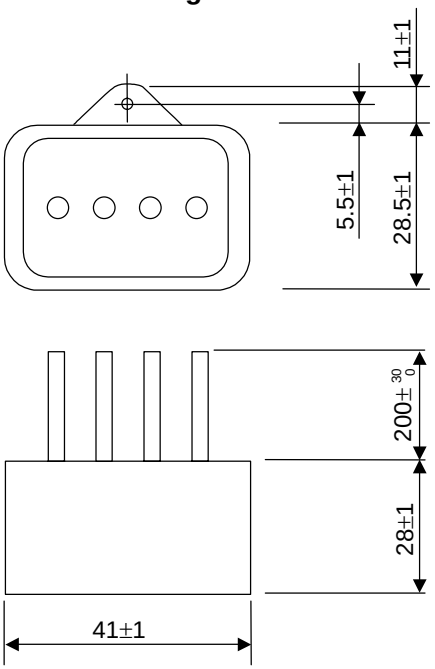


* Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

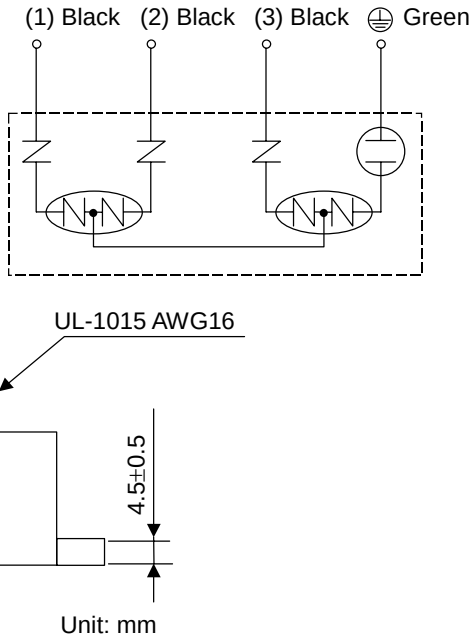
(2) Part name : RAV-781BYZ-4
Manufacturer : Okatani Denki Sangyo

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V ± 10%	Surge resistance level 8/20μs	Surge withstand voltage 1.2/50μs	Static capacity	Working temperature range
250V 3ø	300V	700V	2500A	2kV	75pF	–20°C to +70°C

Outline drawing

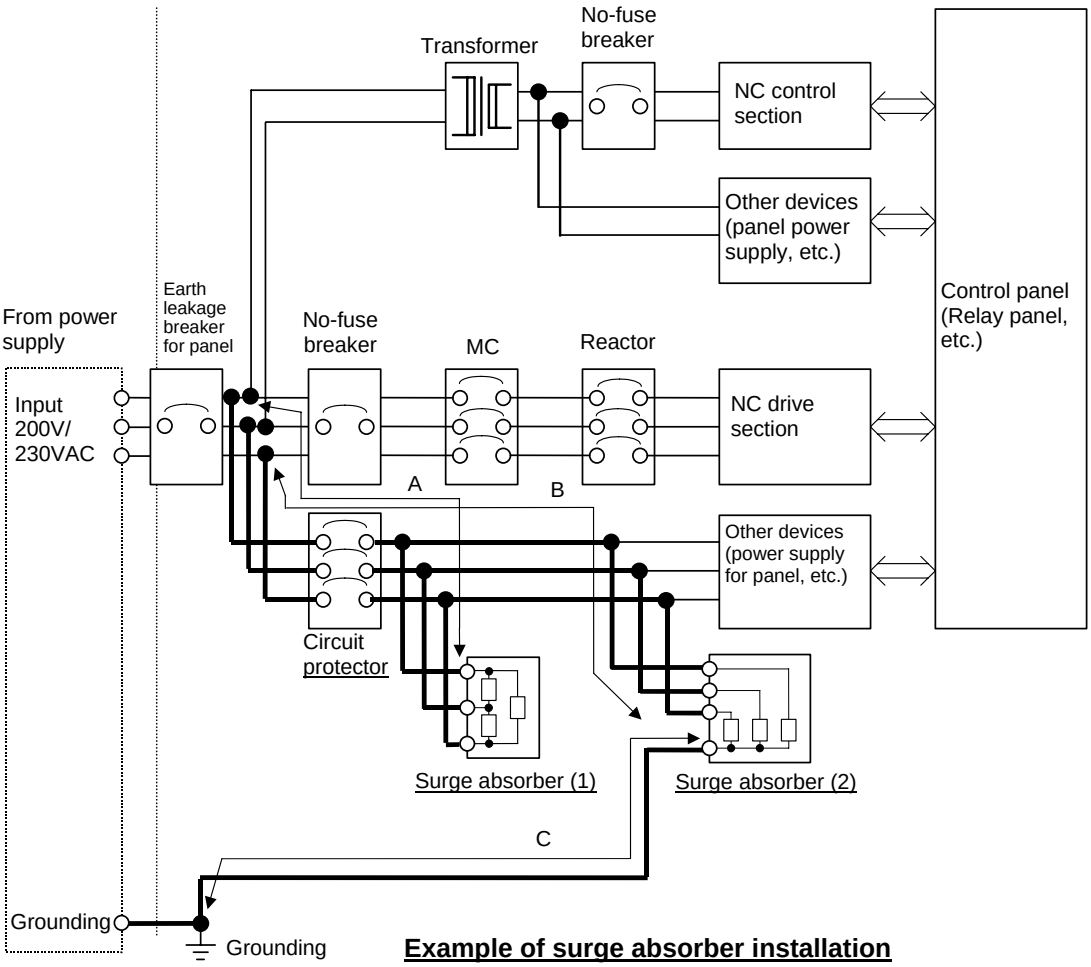


Circuit drawing



* Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

(2) Example of surge absorber installation



Example of surge absorber installation

Precautions

(1) Thick wiring enhances the lightning surge absorption effect, so make the wiring se as thick and short as possible.

Wire material : Wire diameter 2mm^2 or more
Wire length : Connection to surge absorber (1): Wire length (A) is 2m or less
Connection to surge absorber (2): Wire length (B) is 2m or less
Grounding to surge absorber (2) : Wire length (C) is 2m or less

(2) When carrying out a withstand voltage test by applying an overvoltage on the power line, remove surge absorber (2) as it will activate with the applied voltage.

(3) A short-circuit fault will occur if a surge exceeding the tolerance is applied on the surge absorber. Thus, always insert a circuit protector to protect the power supply line.
A current does not flow to surge absorber (1) and (2) during normal use, so the circuit protector can be shared with other devices.

Appendix 9.6.4 Selection of stabilized power supply

Consider the following characteristics when selecting the stabilized power supply (prepared by user). Use a power supply that complies with CE Marking or that follows the Safety Standards given below.

Stabilized power supply selection items

Item			Conditions
Output	Voltage fluctuation	±5%	±5% or less of 24VDC output
	Ripple noise	Max. 120mV	±5% or less of 24VDC output
	Spike noise	Max. 500mV	
Output current		–	Refer to the Connection Manual and calculate.
Output holding time		Min. 20ms	Instantaneous OFF time

Standards

Safety Standards : UL1950, CSA C22.2 No. 234 approved, IEC950 compliant
Noise Terminal Voltage : FCC Class A, VCCI-1 Class
High Harmonics Current Restrictions : IEC1000-3-2

II. Maintenance Manual

1. OUTLINE

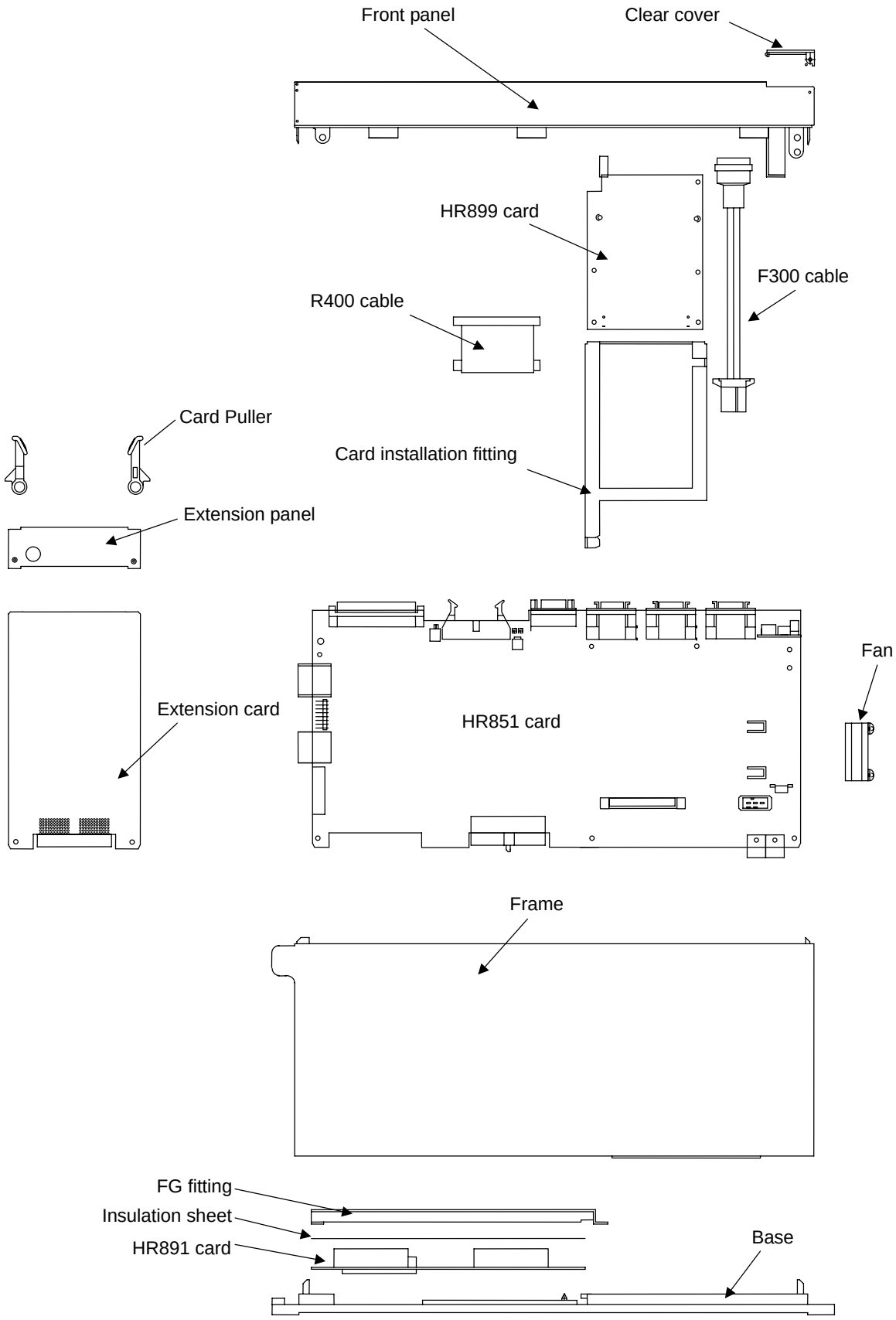
1.1 Table of Configuration Lists

The C6/C64 control unit is configured of the following modules.

Module configuration table

No.	Type	Configuration module type	Function	Remarks
1	Control unit FCU6-MU042 (C64) FCU6-MU043 (C6)	HR851 card	Main CPU card	
		HR899 card	IC Card interface card	
		HR891 card	Back panel	
		109P0424H702	DC fan	Mounted on main CPU card
		ER6 BKO-NC2157H01	Battery	Mounted on main CPU card
		F300 cable	DC24VIN-HR851	
		F400 cable	HR899-HR851	
		Base		Aluminum die-cast
		Frame		Molded resin part
		Front panel		Molded resin part
		Clear cover		Molded resin part
		Card installation fitting		
		FG fitting		
		Insulation sheet		
2	Extension unit (option)	FCU6-HR881	Extension DIO card (Sink type)	HR881 card
		FCU6-HR882	Extension DIO card (Sink type, with AO)	HR882 card
		FCU6-HR883	Extension DIO card (Source type)	HR883 card
		FCU6-HR884	Extension DIO card (Source type, with AO)	HR884 card
		FCU6-EX875	Ethernet	HR875/876 card
		FCU6-EX878	MELSECNET/10 (Coaxial)	HR877/878 card
		FCU6-EX879	MELSECNET/10 (Optical)	HR877/879 card
		FCU6-HR865	CC-Link	HR865 card
		FCU6-EX871-40	DeviceNet	HR871 card

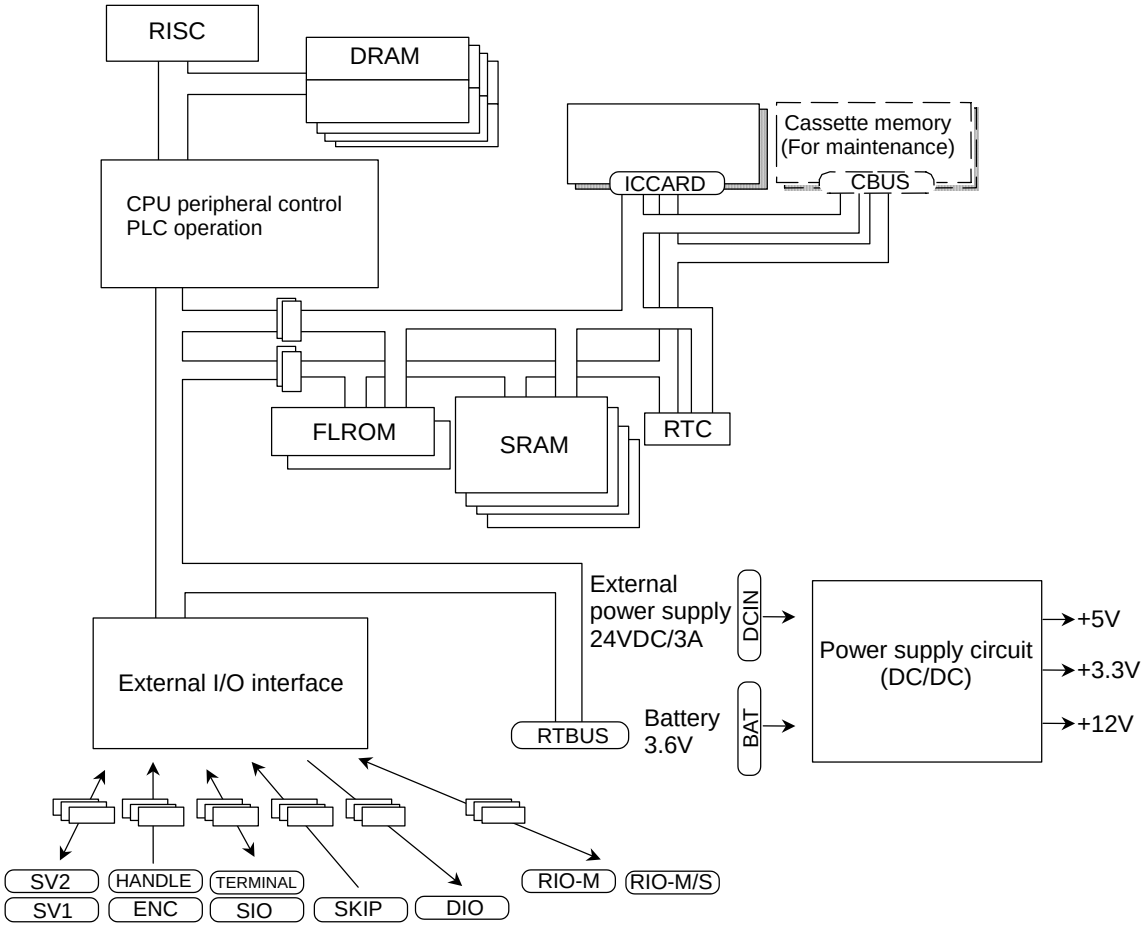
1.2 Control Section Module Configuration



2. EXPLANATION OF MODULE FUNCTIONS

2.1 HR851 Card

[Block diagram]

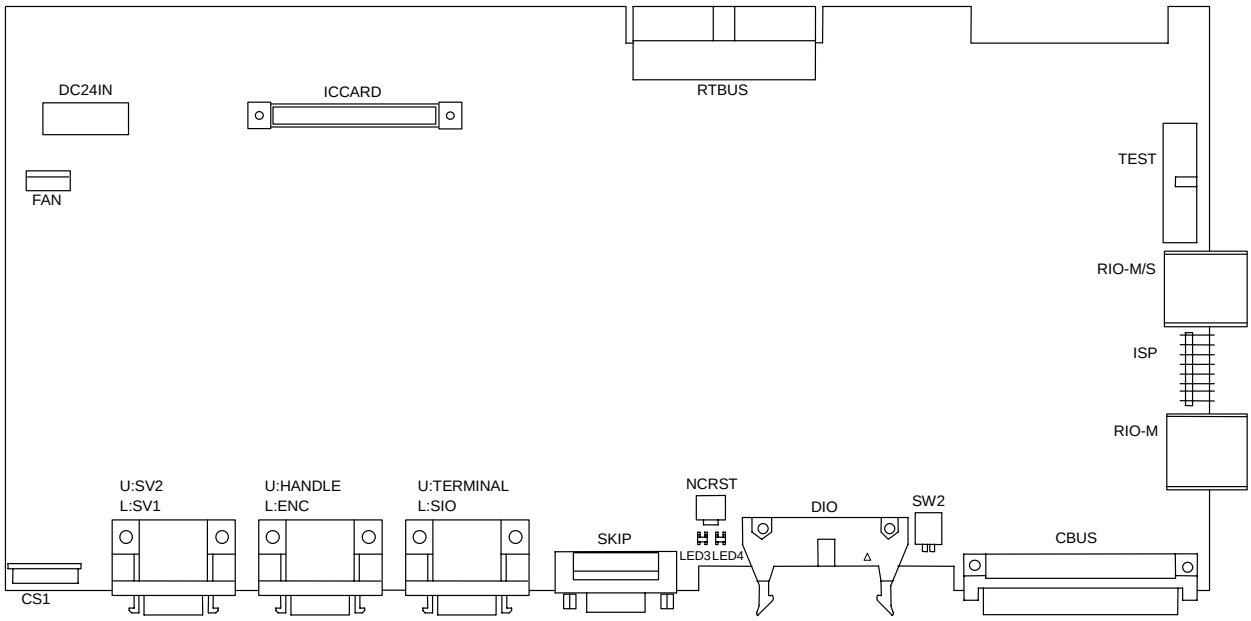


[Explanation of functions]

The HR851 card functions as the main CPU.

CPU	64-bit RISC chip	
ASIC	CPU peripheral control & PLC operation External I/O interface	
Memory	DRAM	For system working
	FLROM	For system ROM & BootROM
	SRAM	For processing program and parameter backup
Cassette I/F	CBUS connector	For cassette memory (for maintenance)
RT bus	RTBUS connector	For back panel connection
I/O interface	SV1, SV2 connector	Servo amplifier connection : 2 systems
	ENC connector	Encoder connection : 2ch
	HANDLE connector	Handle connection : 3ch
	SIO connector	RS-232C: 1ch, RS422: 1ch
	TERMINAL connector	Operation board connection
	SKIP connector	Skip signal connection : 4 points
	DIO connector	Input: 16 points, output: 1 point
	RIO-M connector	Remote IO master station
	RIO-M/S connector	Remote IO master/slave station
Power supply	DC24IN connector	Input : 24VDC±5%: 3A Output : 3.3VDC, 5VDC, 12VDC
	BAT connector	For lithium battery connection

[Connector layout diagram]



TEST : Connector for maintenance and service
NCRST : NC reset (do not press during normal system operation)

[Explanation of settings]

CS1: System mode selection rotary switch

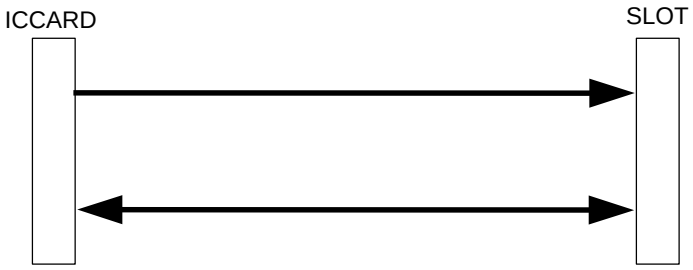
Switch	Mode	Details
0	Standard mode	Operation of system 1
1	PLC stop	The system is started while the PLC is stopped.
2	Maintenance mode	
3		
4		
5		
6		
7		
8	Maintenance mode (The cassette memory must be connected to the CBUS connector.)	
9		
A		
B		
C		
D		
E		
F		

[Explanation of LEDs]

LED3 : (Green) DC power being output
(Red) Battery low warning
LED4 : (Green) SA (servo READY) being output
(Red) Watch dog error

2.2 HR899 Card

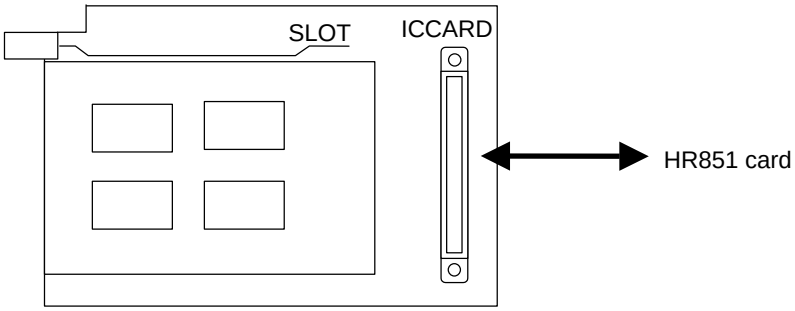
[Block diagram]



[Explanation of functions]

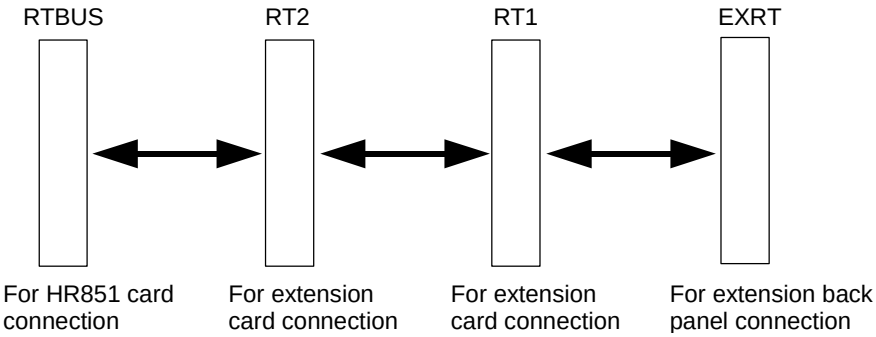
The HR899 card functions as the IC Card interface.

[Connector layout diagram]



2.3 HR891 Card

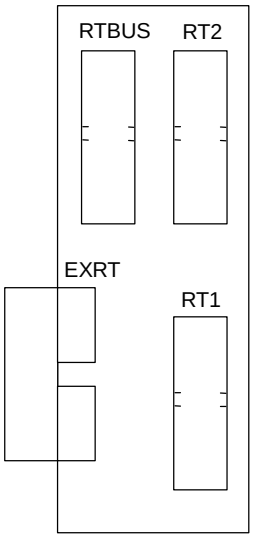
[Block diagram]



[Explanation of functions]

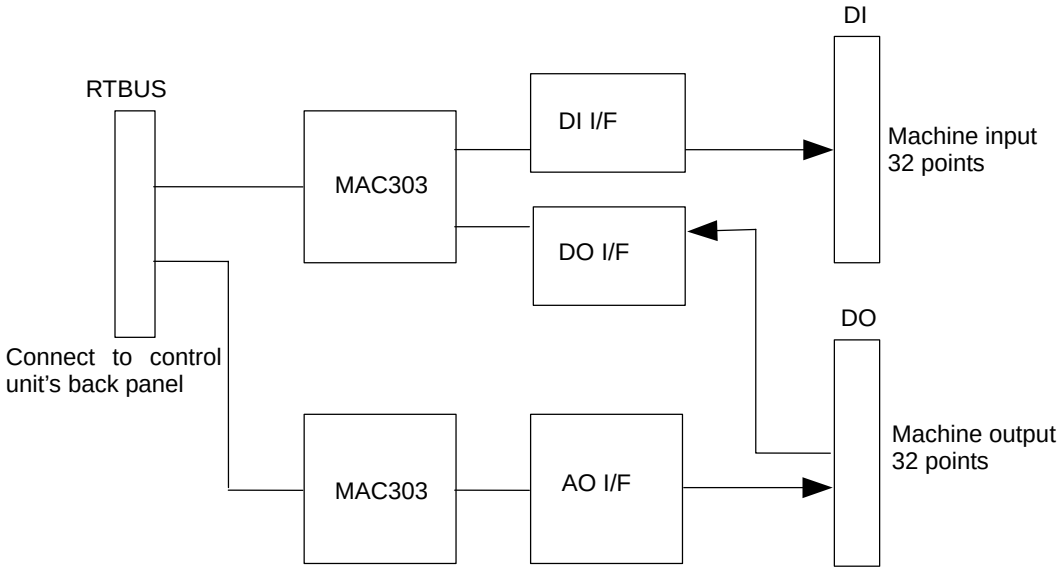
The HR891 card functions as the control unit's back panel.

[Connector layout diagram]



2.4 HR881/882/883/884 Card

[Block diagram]

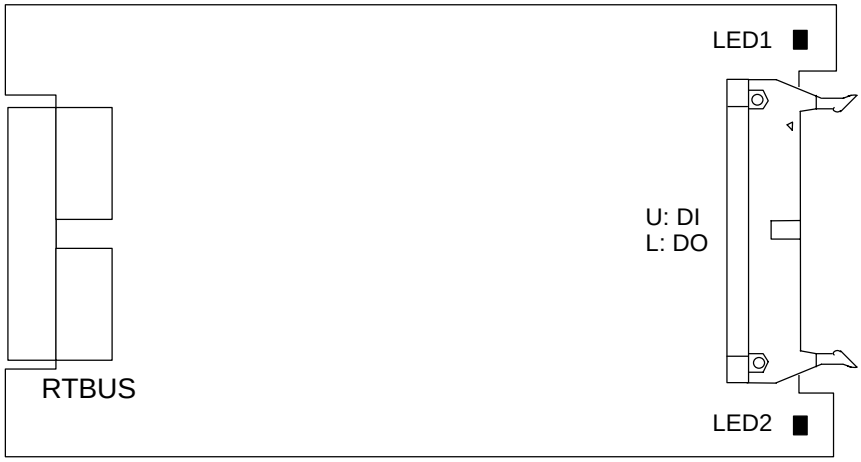


[Explanation of functions]

The HR881/882/883/884 card functions as the control unit built-in extension DIO.

MAC303	Remote I/O controller		
Machine input interface	DI connector	Insulation type	32 points
Machine output interface	DO connector	Non-insulated type	32 points
		HR881/882	Sink specifications
		HR883/884	Source specifications
Analog output interface	DO connector	1 point (HR882/884)	

[Connector layout diagram]

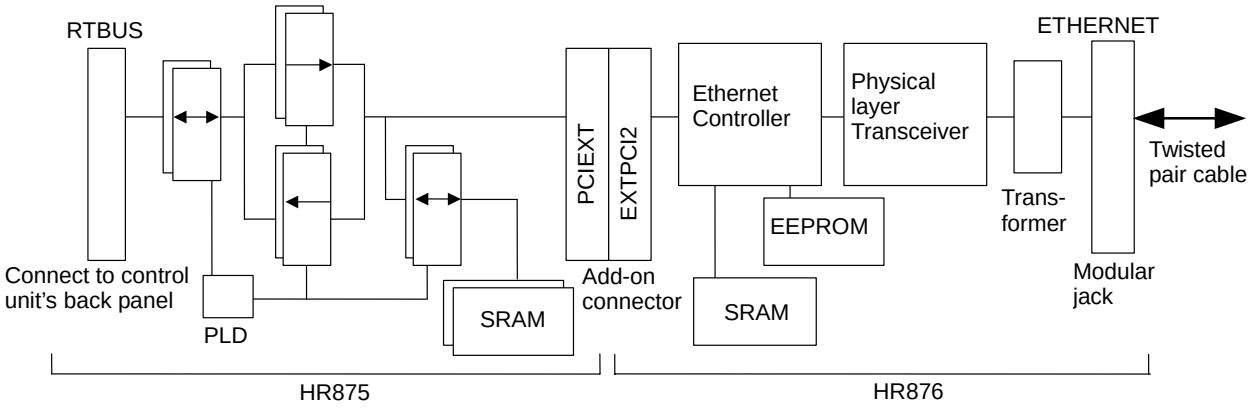


[Explanation of LEDs]

LED1 : (Green) 15VDC being output
(Red) RIO 1st station communication alarm
LED2 : (Green) 15VDC being output
(Red) RIO 2nd station communication alarm

2.5 HR875/876 Card

[Block diagram]



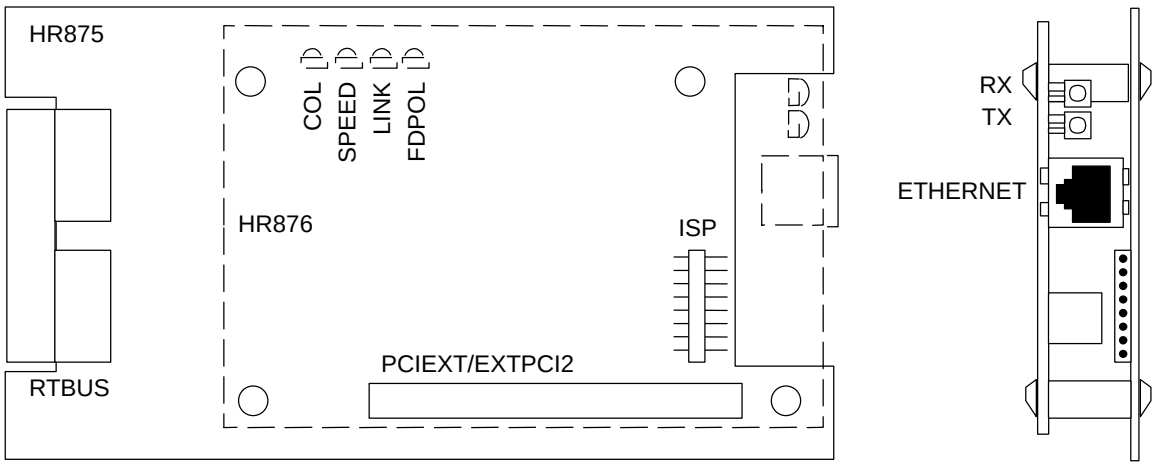
[Explanation of functions]

The HR875/876 card functions as the 10Base-T Ethernet.

☐ Bus conversion section (Base PCB ... HR875)
- Memory SRAM
- Add-on connector

☐ Ethernet interface section (Add-on PCB ... HR876)
- Ethernet Controller
- Physical Layer Transceiver
- Transformer
- Modular jack
- Add-on connector
- Memory SRAM
  EEPROM
- Monitor LED

[Connector layout diagram]

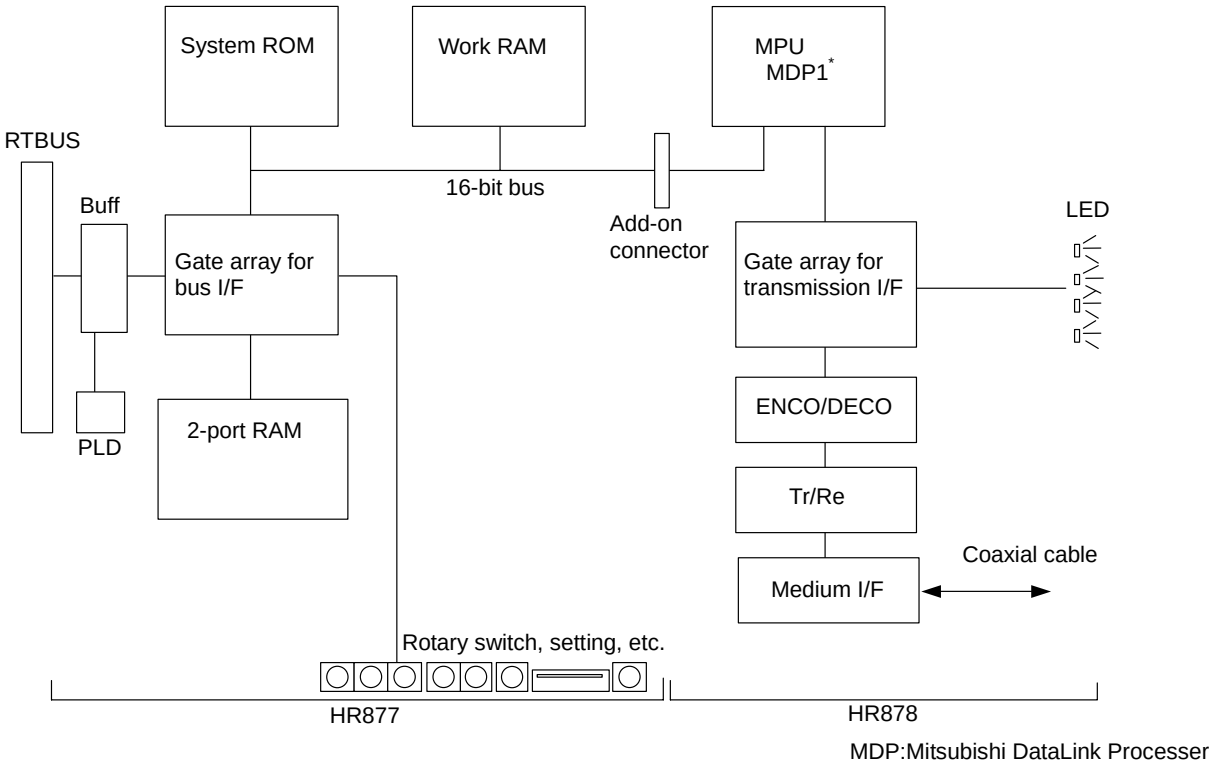


[Explanation of LEDs]

RX : (Green) ON when receiving packet
TX : (Green) ON when transmitting packet
COL : (Green) ON when collision occurs
SPEED : (Green) ON during 100Base-T communication (always OFF)
LINK : (Green) ON when mutual communication is possible
FDPOL : (Green) ON during full-duplex communication

2.6 HR877/878 Card

[Block diagram]



[Explanation of functions]

The HR877/878 card functions as the MELSECNET/10 (coaxial bus interface).

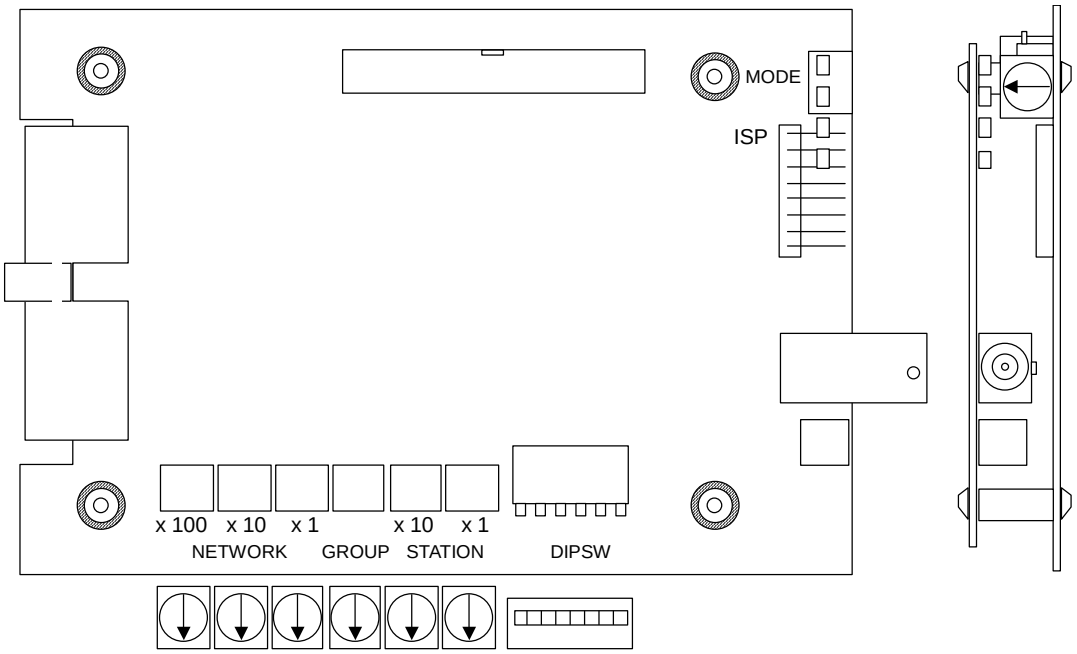
☐ Sections common for coaxial and optical use (Base PCB ... HR877)

ASIC Gate array for bus interface
Memory 2-port RAM
Work RAM
System ROM
Add-on connector
Various setting switches

☐ Sections dedicated for coaxial bus interface (Add-on PCB ... HR878)

MPU
ASIC Gate array for transmission I/F
ENCO/DECO
Tr/Re
Coaxial medium interface
Monitor LED

[Connector layout diagram]



[Explanation of settings]

NETWORK : Network No. setting switch

Set the network number between 1 and 239 with the three rotary switches. The I/F board group No. is the number used when setting the local station network number if connecting to MELSECNET/10.

×100 switch : Set the 100th place of the network number.
×10 switch : Set the 10th place of the network number.
×1 switch : Set the 1st place of the network number.

Set within the range of 1 to 239. (Default setting ×100: 0 ×10: 0 ×1: 1)

GROUP : Group No. setting switch

Set the group number with the rotary switch. The I/F board group No. is the number used when setting the local stations' group No. if connecting to MELSECNET/10.

Set within the range of 1 to 9. 0 means that no group is designated. (Default setting: 0)

STATION : Station number setting switch

Set the station numbers between 01 and 64 with the two rotary switches. The I/F board group No. is the number used when setting the local station number (normal station) if connecting to MELSECNET/10.

×10 switch : Set the 10th place of the station number.
×1 switch : Set the 1st place of the station number.

Set within the range of 1 to 64. (Default setting ×10: 0 ×1: 1)

MODE : Mode setting switch

0: Online (automatic parallel-off valid)
1: Online (automatic parallel-off invalid)
2: Offline
3 to 9: Test mode
D: Network No. confirmation
E: Group No. confirmation
F: Station No. confirmation

	OFF	ON
SW1	: PC-PC network	Remote I/O network
SW2	: Normal station	Control station
SW3	: Common parameter	Default parameter
SW4, 5	: Number of stations	
	off, off: 8 stations	on, off: 16 stations
	off, on: 32 stations	on, on: 64 stations
SW6, 7	: Size	
	off, off: 2K point	on, off: 4K point
	off, on: 6K point	on, on: 8K point

(Default setting: 0)

DIPSW : Network condition setting

This switch is used to set the MELSECNET/10 operation conditions.

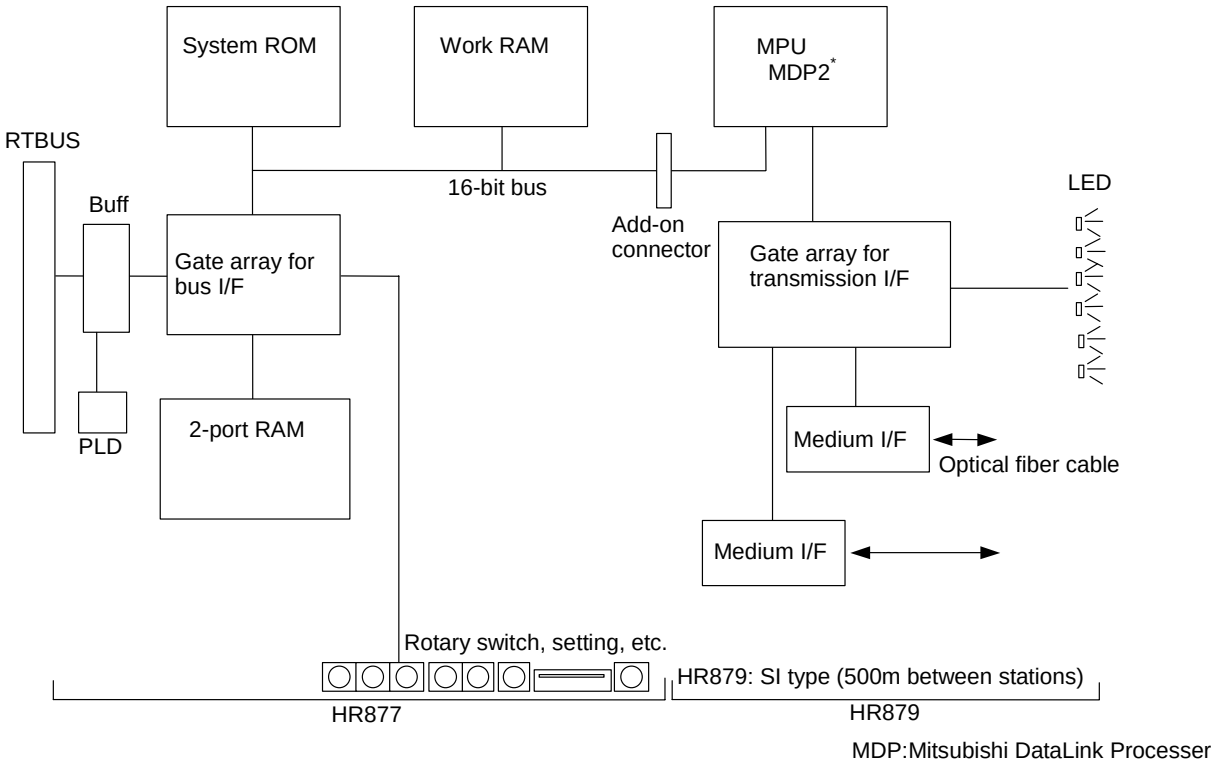
This switch is not used currently. (Always OFF) (Default setting: All OFF)

[Explanation of LEDs]

RUN : (Green) ON when normal
ERR. : (Red) ON when hardware error occurs
SD : (Green) ON during transmission
RD : (Green) ON during reception

2.7 HR877/879 Card

[Block diagram]



[Explanation of functions]

HR877/879 functions as MELSECNET/10 (optical loop interface).

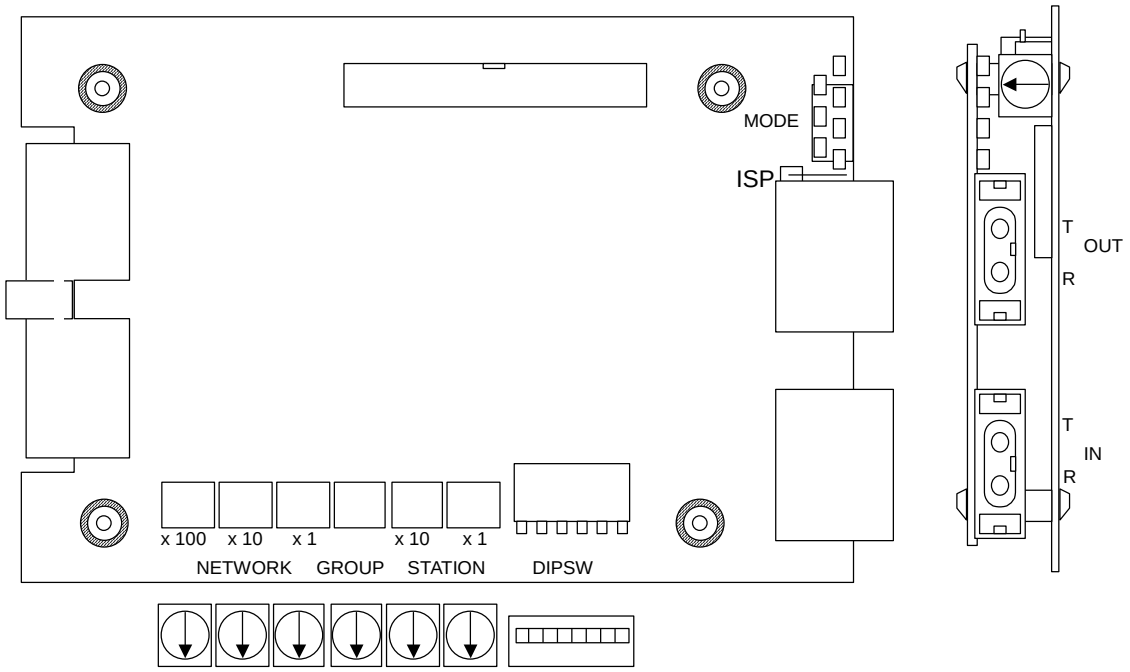
☐ Sections common for coaxial and optical use (Base PCB ... HR877)

ASIC Gate array for bus interface
Memory 2-port RAM
Work RAM
System ROM
Add-on connector
Various setting switches

☐ Section dedicated for optical loop interface (Add-on PCB ... HR879)

MPU
ASIC Gate array for transmission I/F
Optic medium I/F SI type (500m between stations)
Monitor LED

[Connector layout diagram]



[Explanation of settings]

NETWORK : Network No. setting switch

Set the network number between 1 and 239 with the three rotary switches. The I/F board group No. is the number used when setting the local station network number if connecting to MELSECNET/10.

×100 switch : Set the 100th place of the network number.
×10 switch : Set the 10th place of the network number.
×1 switch : Set the 1st place of the network number.

Set within the range of 1 to 239. (Default setting ×100: 0 ×10: 0 ×1: 1)

GROUP : Group No. setting switch

Set the group number with the rotary switch. The I/F board group No. is the number used when setting the local stations' group No. if connecting to MELSECNET/10.

Set within the range of 1 to 9. 0 means that no group is designated. (Default setting: 0)

STATION : Station number setting switch

Set the station numbers between 01 and 64 with the two rotary switches. The I/F board group No. is the number used when setting the local station number (normal station) if connecting to MELSECNET/10.

×10 switch : Set the 10th place of the station number.
×1 switch : Set the 1st place of the station number.

Set within the range of 1 to 64. (Default setting ×10: 0 ×1: 1)

MODE : Mode setting switch

0: Online (automatic parallel-off valid)
1: Online (automatic parallel-off invalid)
2: Offline
3 to 9: Test mode
D: Network No. confirmation
E: Group No. confirmation
F: Station No. confirmation

		OFF	ON
SW1	: PC-PC network		Remote I/O network
SW2	: Normal station		Control station
SW3	: Common parameter		Default parameter
SW4, 5	: Number of stations	off, off 8 stations	on, off 16 stations
		off, on 32 stations	on, on 64 stations
SW6, 7	: Size	off, off 2K point	on, off 4K point
		off, on 6K point	on, on 8K point

(Default setting: 0)

DIPSW : Network condition setting

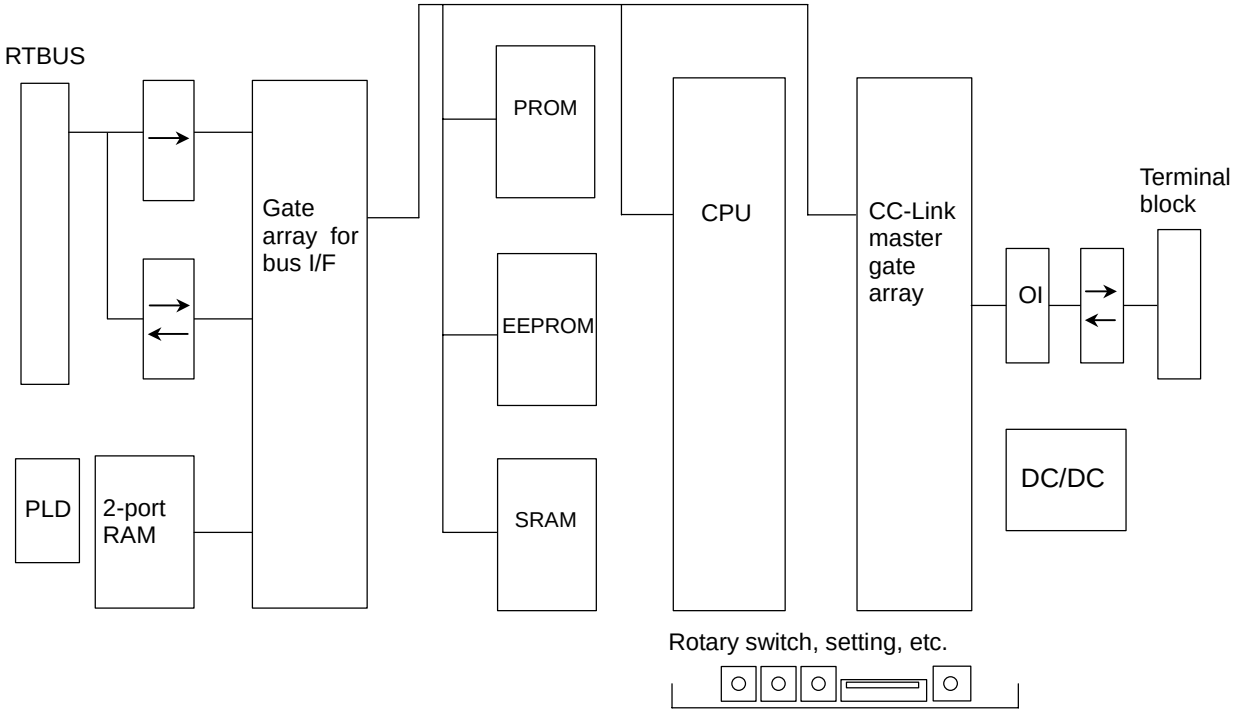
This switch is used to set the MELSECNET/10 operation conditions.
This switch is not used currently. (Always OFF) (Default setting: All OFF)

[Explanation of LEDs]

RUN : (Green) ON when normal
F.ERR : (Red) ON when main (forward) loop hardware error occurs
R.ERR : (Red) ON when sub (reverse) loop hardware error occurs
F.SD : (Green) ON during main (forward) loop transmission
F.RD : (Green) ON during main (forward) loop reception
R.SD : (Green) ON during sub (reverse) loop transmission
R.RD : (Green) ON during sub (reveres) loop reception

2.8 HR865 Card

[Block diagram]



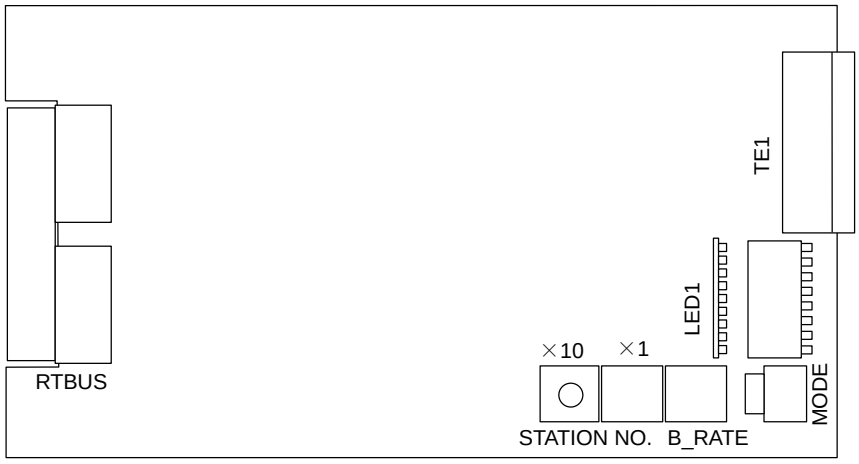
[Explanation of functions]

The HR865 card functions as the CC-Link's master/local station.

CPU	16bitCPU	
ASIC	Gate array for bus interface	
	CC-Link master gate array	
Memory	2-port RAM	SRAM
	System ROM	PROM
	Work RAM	SRAM
		EEPROM

Various setting switches
LED

[Connector layout diagram]



[Explanation of settings]

MODE : Mode setting switch

Set the unit's operation state (Default setting: 0)

		Master station	Local station
0	: Online (remote net mode)	Possible	Possible
1	: Online (remote I/O net mode)	Possible	Not possible
2	: Offline	Possible	Possible
3	: Line test 1	Possible	Not possible
4	: Line test 2	Possible	Not possible
5	: Parameter confirmation test	Possible	Not possible
6	: Hardware test	Possible	Possible

7 to F: Not usable

STATION NO. : Station number setting switch

Set the unit's station No. (Default setting: 0)

During remote net mode
Master station: 0
Local station: 1 to 64
Standby master station: 1 to 64
(If a value other than 0 to 64 is set, the "SW" and "L ERR." LEDs will light.)

During remote I/O net mode
Master station: 1 to 64 (set station number of final remote I/O station)
(If 0 is set, the "PLM" LED will light.)

B RATE : Transmission speed setting switch

Set the unit's transmission speed. (Default setting: 0)

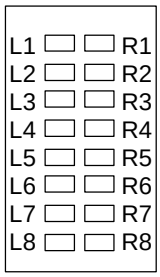
0 : 156kbps
1 : 625kbps
2 : 2.5Mbps
3 : 5Mbps
4 : 10Mbps
5 to 9 : Setting error ("SW" and "L ERR." LEDs light)

DIPSW (SW5) : Condition setting switch

Set the operation conditions (Default setting: All OFF)

SW1	Station type	OFF: Master station/local station ON: Standby master station		
SW2	Use not possible	Always OFF		
SW3	Use not possible	Always OFF		
SW4	State of input data in data link error station	OFF: Clear ON: Hold		
SW5, 6	Number of occupied stations	SW5	SW6	
		OFF	OFF	: Station 1
		OFF	ON	: Station 2
		ON	ON	: Station 3
		ON	OFF	: Station 4
SW7	Use not possible	Always OFF		
SW8	Use not possible	Always OFF		

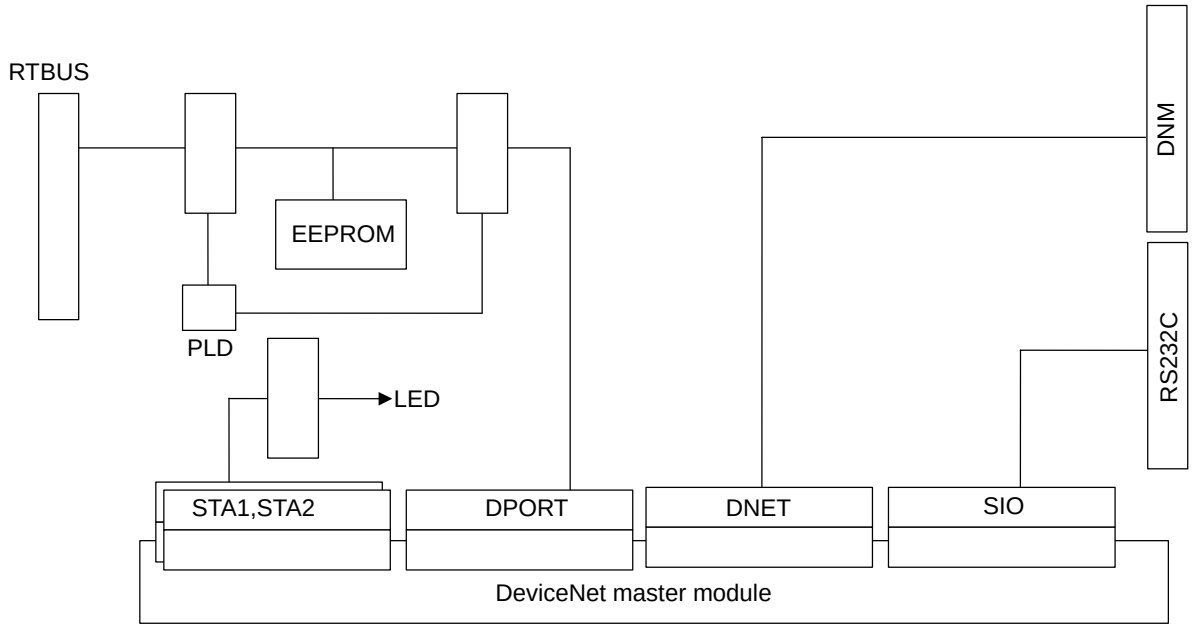
[Explanation of LEDs]



LED name			Details	LED display status			
				Master station (Standby master station)		Local station (Standby master station)	
				When normal	When abnormal	When normal	When abnormal
L1	RUN		ON : Unit is normal OFF : Watch dog timer error has occurred.	ON	OFF	ON	OFF
L2	ERR.		Indicates the state of communication with station set in parameters. ON : Error in communication with all stations Flicker : Station with communication error round	OFF	ON/flicker	OFF	ON/flicker
L3	MST		ON : Set as master station	ON	–	OFF	–
L4	S MST		ON : Set as standby master station	ON	–	ON	–
L5	LOCAL		ON : Set as local station	OFF	–	ON	–
L6	CPU R/W		ON : Communicating with NC CPU (FROM/TO)	ON	OFF	ON	OFF
L7	L RUN		ON : Executing data link (local station)	ON	OFF	ON	OFF
L8	L ERR.		ON : Communication error (local station) Flicker : Switch setting was changed while power is ON	OFF	ON/flicker	OFF	ON/flicker
R1	ERROR	SW	ON : Switch setting is incorrect	OFF	ON	OFF	ON
R2		M/S	ON : A master station already exists on same line	OFF	ON	–	–
R3		PRM	ON : Error found in parameter details	OFF	ON	–	–
R4		TIME	ON : Data link monitor timer functioned (all-station error)	OFF	ON	–	–
R5		LINE	ON : Cable is broken or transmission path is being affected by noise, etc.	OFF	ON	OFF	ON
R6				–	–	–	–
R7	SD		ON : Sending data	ON	OFF	ON	OFF
R8	RD		ON : Receiving data	ON	OFF	ON	OFF

2.9 HR871 Card

[Block diagram]

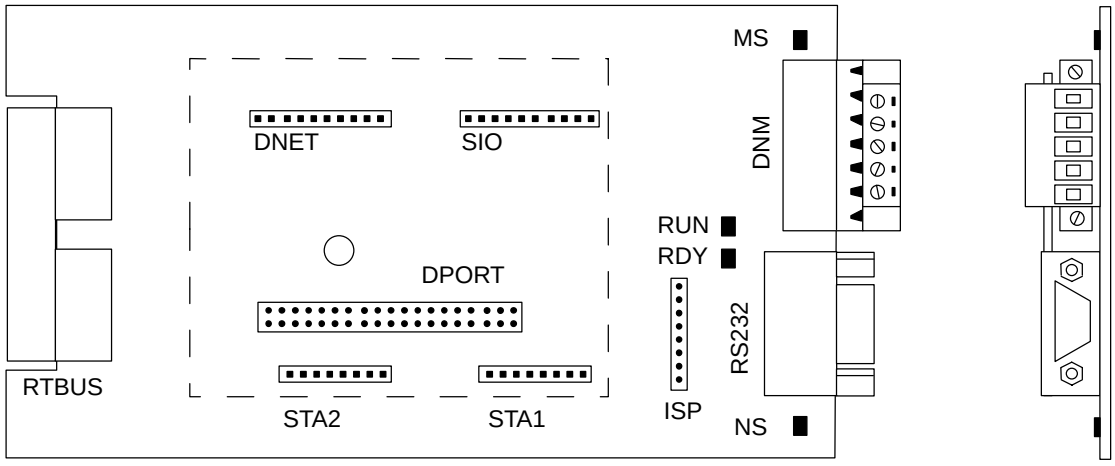


[Explanation of functions]

The HR871 card functions as the DeviceNet master when the DeviceNet master module is added on.

Memory EEPROM
Add-on connector
Communication connector
RS-232C connector for configuration
Monitor LED

[Connector layout diagram]

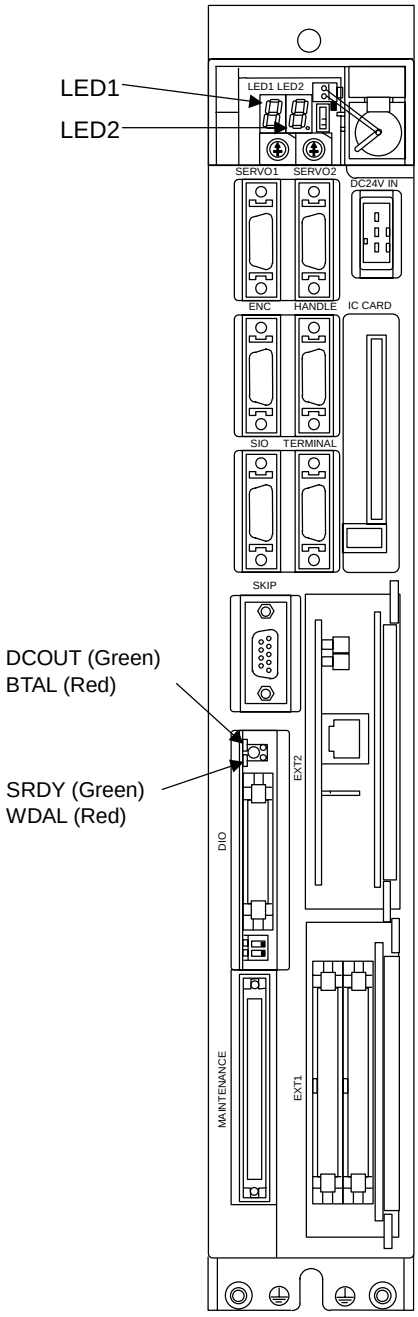


[Explanation of LEDs]

RUN : (Green) ON during communication
RDY : (Green) ON when hardware is correct
MS : (Green) ON during communication
NS : (Green) ON during communication
: (Red) ON when duplicate station No. setting occurs or bus off error occurs

3. TROUBLESHOOTING

3.1 List of Unit LEDs



[Explanation of LED functions]

Name	Function	Color	Status		Correspondence for error
			When normal	During error	
LED1	7-segment system status display	Red	Follows system status		Refer to section 3.2.2 (2).
LED2					
DCOUT	During internal power output	Green	Lit	Not lit	Refer to section 3.2.2 (1).
BTAL	Battery drop warning	Red	Not lit	Lit	Refer to section 3.2.2 (1).
SRDY	Servo READY (SA)	Green	Lit	Not lit	Refer to section 3.2.2 (2).
WDAL	Watch dog error	Red	Not lit	Lit	Refer to section 3.2.2 (2).

3.2 Troubleshooting

3.2.1 Confirmation of trouble state

Confirm "when", "when doing what", and "what kind of" trouble occurred.

(1) When?

What time did the trouble occur?

(2) When doing what?

What was the NC operation mode?

- During automatic operation ..... Program No., sequence No. and program details when the trouble occurred.
- During manual operation ..... What was the manual operation mode?
  What was the operation procedure?
  What were the previous and next steps?
- What was the setting and display unit screen?
- Did the trouble occur during input/output operations?
- What was the machine side state?
- Did the trouble occur while replacing the tools?
- Did hunting occur in the control axis?

(3) What kind of trouble?

- What was displayed on the setting and display unit's Alarm Diagnosis screen?
  Display the Alarm Diagnosis screen, and check the alarm details.
- What was displayed for the machine sequence alarm?
- Is the LCD screen normal?

(4) How frequently?

- When did the trouble occur? What was the frequency? (Does it occur when other machines are operating?) If the trouble occurs infrequently or if it occurs during the operation of another machine, there may be an error in the power voltage or the trouble may be caused by noise, etc. Check whether the power voltage is normal (does it drop momentarily when other machines are operating?), and whether noise measures have been taken.
- Does the trouble occur during a specific mode?
- Does the trouble occur when the overhead crane is operating?
- What is the frequency in the same workpiece?
- Check whether the same trouble can be repeated during the same operation.
- Check whether the same trouble occurs when the conditions are changed. (Try changing the override, program details, and operation procedures, etc.)
- What is the ambient temperature?
  (Was there a sudden change in the temperature? Was the fan at the top of the control unit rotating?)
- Is there any contact defect or insulation defect in the cables?
  (Has any oil or cutting water splattered onto the cables?)

3.2.2 When in trouble

If the system does not operate as planned or if there is any trouble in the operation, confirm the following points and then contact the Mitsubishi Service Center.

– Examples of trouble –

- The power does not turn ON.
- The power turns OFF suddenly.
- Nothing appears in the screen.
- The operation keys do not function.
- Machining operation is not possible.

(1) Problems related to the power supply

The power does not turn ON.

Cause	Remedy
The door interlock is applied.	If the control panel door is not completely closed, close it. If the door interlock is applied even when the door is closed, the door interlock circuit is damaged.
The external power supply's input voltage is not as specified.	Check that the input voltage is within 200 to 230VAC +10 to –15%.
The external power supply is faulty.	Check that the power can be turned ON with the external power supply only. **Note)** Depending on the external power supply, the power may not turn ON in the no-load state, so install a slight load and check.

The external power turns ON but the NC control power does not turn ON.

Cause	Remedy
The external power supply output is not correct.	Disconnect the cable between the NC unit and the external power supply, and check that the external power supply output is normal.
The power cable is disconnected or broken.	Check the cable connected between the NC unit and external power supply, and securely insert it. Check that the cable is not broken, and replace if broken.
The cable connected from the NC unit to the peripheral device is short-circuited.	Disconnect the cable connected to the peripheral device one at a time and check that the power turns ON. Check that there are no short-circuited cables.
There is a short circuit in the configuration card.	Remove the removable cards one at a time and check that the power turns ON. Check that there are no short-circuited cards.

⚠ **CAUTION**

- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⃠ Do not connect or disconnect the PCBs while the power is ON.

The power turns OFF.		
	Cause	**Remedy**
	There is a problem in the power supply.	Check whether the voltage fluctuates at certain time zones. Check whether an instantaneous power failure has occurred.
	A problem occurs when the peripheral device starts operating.	Check whether the voltage drops instantaneously when the peripheral device operation starts.
The BTAL (red) LED on the control unit lights.		
	Cause	**Remedy**
	This lights when the voltage of the battery connected to the BAT connector drops to 2.6V or less.	Replace the battery following the procedures given in section 4.3.2 (1).

(2) Problems when starting the system

The NC does not start up correctly.		
	Cause	**Remedy**
	8 is displayed on the control unit 7-segment display LED1 (left side).	Check that the rotary switch CS1 (left side) is set to 0.
	E or F is displayed on the control unit 7-segment display LED1 (left side).	Contact the Mitsubishi Service Center.
	The WDAL (red) LED on the control unit lights.	Contact the Mitsubishi Service Center.
Servo READY (SA) does not turn ON.		
	Cause	**Remedy**
	The SRDY (green) LED on the control unit is not lit.	Check the emergency stop conditions.
	The SRDY (green) LED on the control unit is lit.	Check that the wiring past the DIO connector is correct. (Check the relay coil's diode connection, etc.) If there is no output even when the wiring is corrected, the control unit may be faulty. Check the voltage with a tester. (The voltage is correct if it is approx. 24V across the relay coil end or connector DIO's 1B pin (+) and 1A pin (–) when the LED is lit.)

⚠ **CAUTION**

- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.
- Do not connect or disconnect the PCBs while the power is ON.

(3) Problems related to remote I/O

The communication alarm LED ALM (red) lights.

Cause	Remedy
The remote connection cable is not connected. The cable is disconnected or has a connector contact fault.	Check the connection of the R211 cable between the NC control section and remote I/O unit.
The remote I/O unit is faulty.	Contact the Mitsubishi Service Center, and then replace the card.

The power system LED POWER (green) turns OFF.

Cause	Remedy
The input power is not being supplied.	Supply a +24V±5% voltage to the Remote I/O unit.
(The input power is not within the tolerable range, or the internal power is faulty.)	Check that the input voltage is not +20V or less. If it is being supplied correctly, contact the Mitsubishi Service Center.

(4) Problems related to Ethernet

A communication error message is appeared on the display, and the communication LEDs RX (green) and TX (green) turn OFF.
In other cases, a communication error message is appeared on the display, and after the OK button is pressed, the communication error message appears again and the communication LEDs RX (green) and TX (green) turn OFF.

Cause	Remedy
The Ethernet cable is not connected, is broken, or there is a contact fault at the connector.	Check the cable connected between the NC control unit and display.
A straight type Ethernet cable is in use.	Use a cross type Ethernet cable.
The Ethernet unit is not inserted to the very back.	Insert the Ethernet unit so that the plate is flush with the front panel.
The Ethernet unit is faulty.	Contact the Mitsubishi Service Center and replace the unit.

⚠ CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⃠ Do not connect or disconnect the PCBs while the power is ON.

4. DAILY MAINTENANCE AND PERIODIC INSPECTION AND MAINTENANCE

4.1 Maintenance Tools

(1) Measuring instruments

The following measuring instruments are used to confirm that the voltage is being supplied correctly to the NC unit, to confirm that the wiring to the NC unit is correct, and to carry out simple troubleshooting.

Table 2.1 Maintenance tools

Tool	Condition	Application
Tester		To check that the wiring to the NC unit is correct before turning the power ON.
AC voltmeter	Measure the AC power voltage. The tolerable error is ±2% or less.	To measure the AC power voltage being supplied to the external 24VDC power supply unit.
DC voltmeter	Max. scale 30V. The tolerable error is ±2% or less.	To measure the DC power voltage. External power supply 24V (control section, machine input/output interface) Battery voltage HR851 SA output
Synchroscope		General measurement and simple troubleshooting

Note 1) Currently, a high precision digital multi-meter is commonly used as a tester. This digital multi-meter can be used as both an AC voltmeter and a DC voltmeter.

(2) Tools

Screwdriver (large, medium, small)
Radio pliers

4.2 Maintenance Items

Maintenance is categorized into daily maintenance items (items to be carried at set intervals) and periodic maintenance (replacement of parts when life is reached).
Some parts will not function in a hardware manner when the life is reached, so these should be replaced before the life is reached.

Table 2.2 List of maintenance items

Class	Name	Life	Inspection/replacement	Remarks
Daily maintenance	Escutcheon (when using communication terminal)		Once/two months (Accordingly when dirty)	Refer to section 4.2.1.
Periodic maintenance	Battery (lithium battery)	Cumulative data holding time 45,000h	When battery drop caution alarm occurs (Guideline: approx. 5 years)	Refer to section 4.3.2 (1).
	Cooling fan (control section)	30,000h	Refer to left.	Refer to section 4.3.2 (2).
	LCD display unit (when using communication terminal)	10,000h (Specified by the power ON time that the brightness drops to less than 50%.)	Replace when backlight darkens.	Refer to section 4.2.2.

4.2.1 Escutcheon

(1) Cleaning the escutcheon

1) Keep the rear side of the escutcheon as clean as possible.
2) Wipe the escutcheon with a soft, clean, dry cloth. If cleaning is still required, put some neutral detergent on a cloth and wipe. Do not use alcohol, thinner, etc.

4.2.2 LCD Panel

(1) Handling the LCD panel

(a) Precautions for use

1) The polarizing plate (display surface) of the LCD panel surface can be easily scratched, so be careful during handling.
2) Glass is used in the LCD panel. Be careful not to drop the LCD panel or allow it to hit hard objects, as the glass may chip or break.
3) The polarizing plate may be stained or discolored if drops of water, etc., adhere to it for long periods, so be sure to wipe off any moisture immediately.
4) Wipe off any dirt, dust, etc., on the polarizing plate using absorbent cotton or other soft cloth.
5) A CMOS LSI is used in the LCD panel, so be careful of static electricity when handling.
6) Never disassemble the LCD panel. Doing so will damage the panel.

(b) Precautions for storage

1) Do not store the LCD panel in locations having a high temperature or humidity. (Store within the storage temperature range.)
2) When storing the LCD panel as an individual unit, be sure that other objects do not touch or hit the polarizing plate (display surface).
3) When storing the LCD panel for extended periods, be sure to store in a dark place away from exposure to direct sunlight or fluorescent light.

(2) Other precautions for use

(a) Backlight life

The life of the backlight is 25,000 hours/25°C. (Time for luminance to drop to 50% of the initial value.)
The backlight life is dependent on the temperature. The life tends to be shorter when used continuously at lower temperatures.

(b) Luminance start

Due to the characteristics of the backlight, the luminance could drop slightly at lower temperatures. It will take approx.10 to 15 minutes for the luminance to reach the rated value after the power is turned ON.

(c) Unevenness, luminescent spots and irregularities

Uneven brightness, small luminescent spots or small dark spots may appear on LCD, but this is not a fault.

(d) Contrast

The contrast of STN method LCD panels changes with temperature fluctuation. If this happens and the panel is difficult to see, open the operation box door and adjust the contrast with the contrast adjustment potentiometer on the LCD signal interface PCB.
When using the 10.4 LCD, the brightness can be adjusted with the parameter settings.

4.2.3 IC Card

(1) Handling the IC card

The general handling methods for the IC card are described below.
Refer to the instruction manual of the IC card used for details.

(a) Precautions for use

1) Insert the card in the correct direction.
2) Do not touch the connector area with the hands or metal.
3) Do not apply excessive force to the connector area.
4) Do not subject the card to bending or strong impacts.
5) Do not open the cover or disassemble the card.
6) Do not use the card in dusty locations.

(b) Precautions for storage

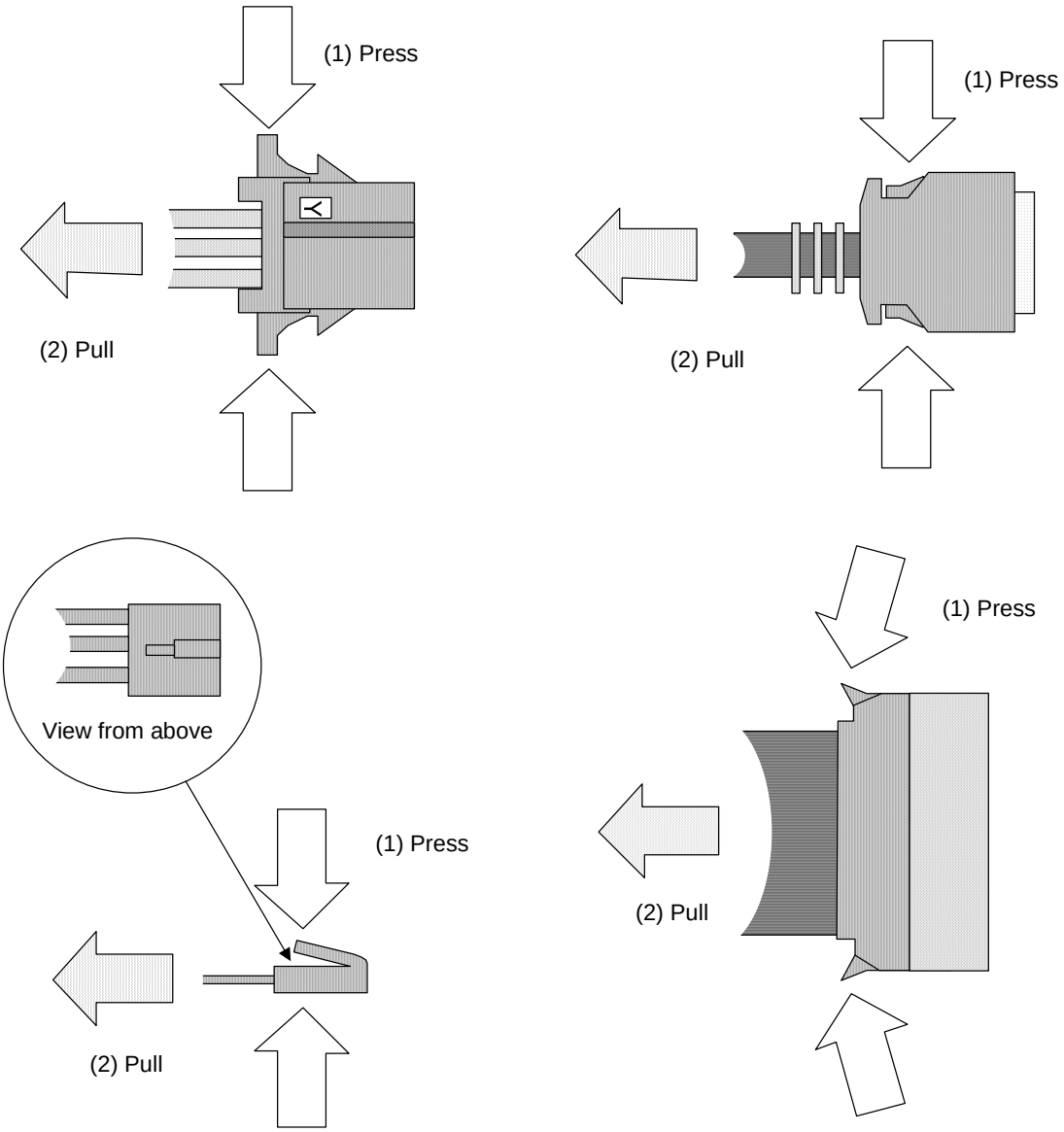
1) Do not store the card in locations having a high temperature or humidity.
2) Do not store the card in dusty locations.

4.3 Replacement Methods

4.3.1 Cable

If the cable is replaced without turning the power OFF, the normal unit or peripheral devices could be damaged, and risks could be imposed.
Disconnect each cable with the following procedures.

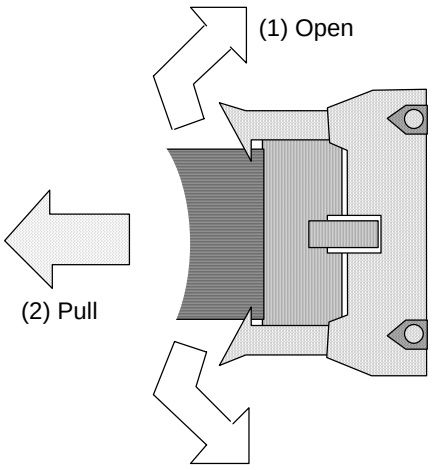
(1) For the following type of connector, press the tabs with a thumb and forefinger in the direction of the arrow, and pull the connector off.



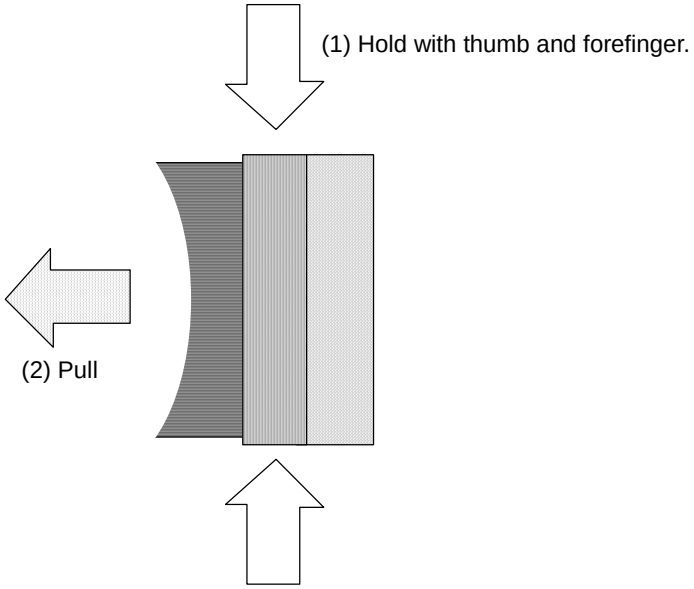
⚠ CAUTION

- ⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⃠ Do not pull the cables when connecting/disconnecting it.

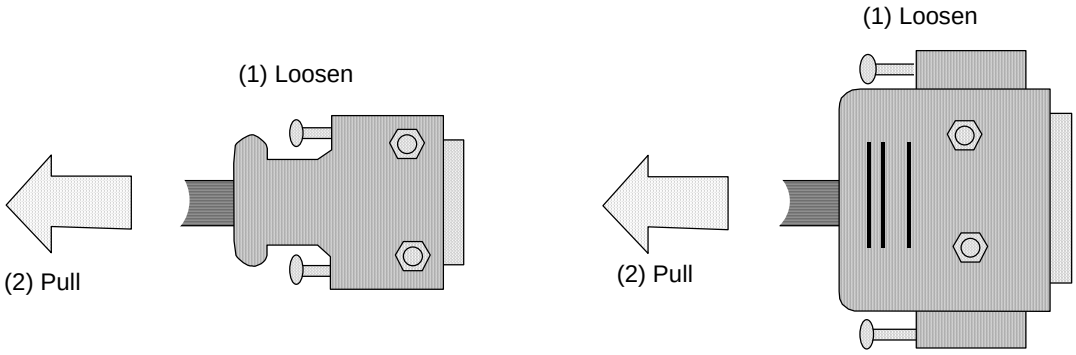
(2) For a flat cable type connector with latches, open the latches in the directions of the arrows, and pull the connector off.



(3) For a flat cable type connector without latches, hold the connector with a thumb and forefinger, and pull the connector off.



(4) For the screw fixed type connector, loosen the two fixing screws, and pull the connector off.



⚠ CAUTION

- ⃠ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⃠ Do not pull the cables when connecting/disconnecting it.

4.3.2 Durable parts

(1) Battery

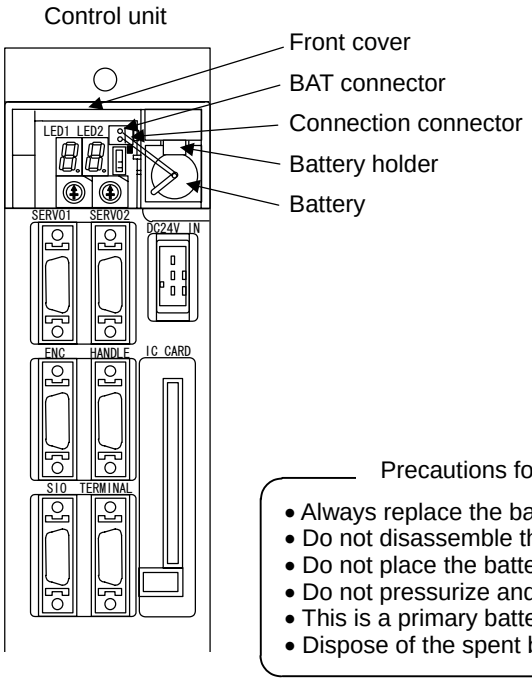
All data, such as the parameters and machining programs that need to be backed up when the power is turned OFF, are saved by a lithium battery installed in the control unit battery holder.

Battery	With ER6 connector (Toshiba with Mitsubishi specifications)
Initial battery voltage	3.6V
Voltage at which voltage drop is detected	2.8V (Battery voltage drop caution alarm) 2.6V (Battery voltage drop warning alarm)
Battery cumulative data hold time	45,000 hours (At room temperature. The life will be shorter if the temperature is high.)
Battery life	Approx. 5 years (from date of battery manufacture)
Discharge current	40μA or less

(Replace the battery when the battery voltage drop warning alarm appears in the NC screen. The internal data could be damaged if the battery voltage drop warning alarm appears.)

Always replace the battery with the control unit power turned OFF.
Complete the replacement within 30 minutes after turning the power OFF. (If the battery is not connected within 30 minutes, the data being backed up will be destroyed.)

(1) Confirm that the control unit power is OFF. (If the power is not OFF, turn it OFF.)
(2) Open the upper front cover of the control unit.
(3) Remove the battery from the battery holder.
(4) Pullout the connector connected from the battery from the BAT connector.
(5) Replace with a new battery, and connect the connection connector from the battery to the BAT connector.
(6) Fit the battery into the battery holder.
(7) Close the front cover of the control unit.



Precautions for handling battery

- Always replace the battery with the same type.
- Do not disassemble the battery.
- Do not place the battery in flames or water.
- Do not pressurize and deform the battery.
- This is a primary battery so do not charge it.
- Dispose of the spent battery as industrial waste.

⚠ CAUTION

- **If the battery voltage low warning alarm occurs, the program, tool data and parameters, etc., could be damaged. After replacing the battery, reload all data with the input/output device.**
- **⚠ Do not replace the battery while the power is ON.**
- **⚠ Do not short-circuit, charge, overheat, incinerate or disassemble the battery.**
- **⚠ Dispose of the spent battery according to local laws.**

(2) Cooling fan

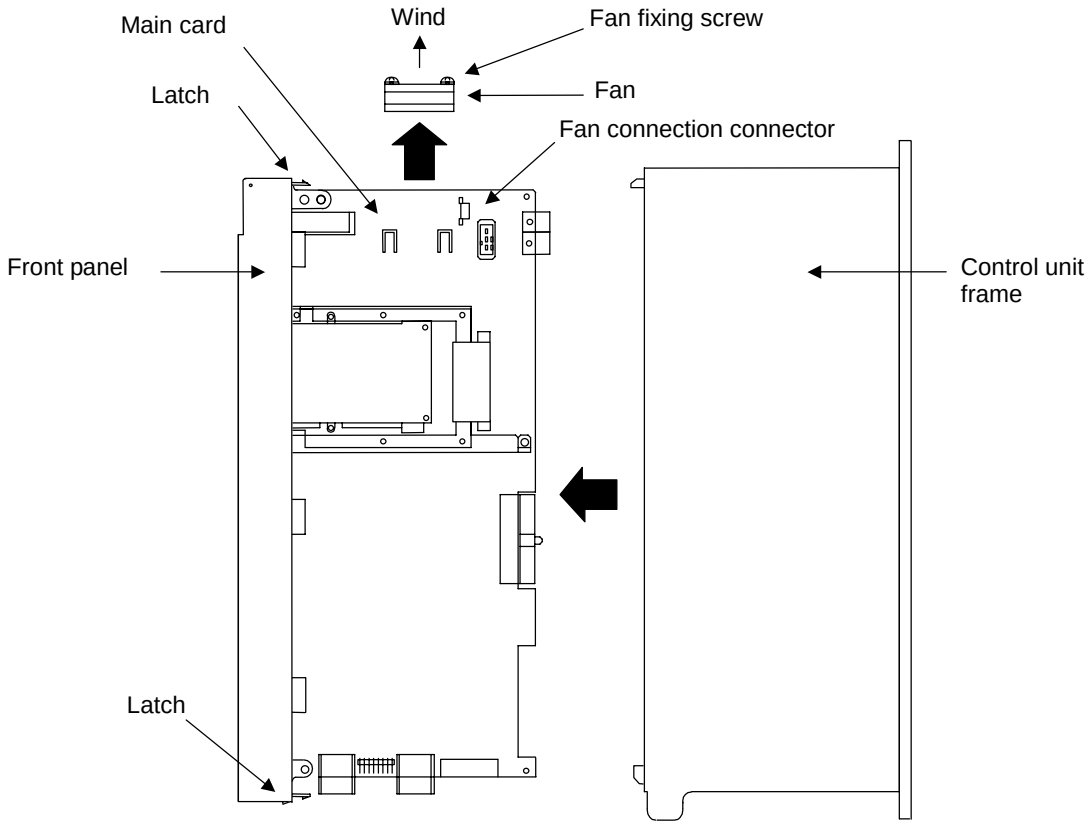
A fan is mounted on the control unit to cool the inside of the control unit.

Applicable cooling fan ..... 109P0424H702 (Sanyo Denki) or
MMF-04C24DS-ROF (Melco Technolex)

Cooling fan life..... 30,000 hours

Always turn the control section power OFF before replacing the control unit's cooling fan.

(1) Confirm that the control unit power is OFF. (If the power is not OFF, turn it OFF.)
(2) Disconnect all cables connected to the control unit's connectors.
(3) Remove all cards mounted in the control unit's extension slots.
(4) Press the latches at the top and bottom of the control unit's front panel, and pull the front panel with the main card.
(5) Remove the two fan fixing screws installed on the main card.
Take care at this time, as if the main card is contacted against metal sections, the data backed up in the memory will be damaged.
(6) Disconnect the fan's connection connector.
(7) Replace with the new fan, and connect the fan's connection connector to the main card.
(8) Fix the fan with the two fan fixing screws.
Make sure that the fan faces the blowoff direction at this time.
(9) Align the main card with the rails on the control unit frame, and press in until the latches lock.
(10) Mount the cards in the control unit's extension slots.
(11) Correctly connect all cables that were connected.



⚠ CAUTION

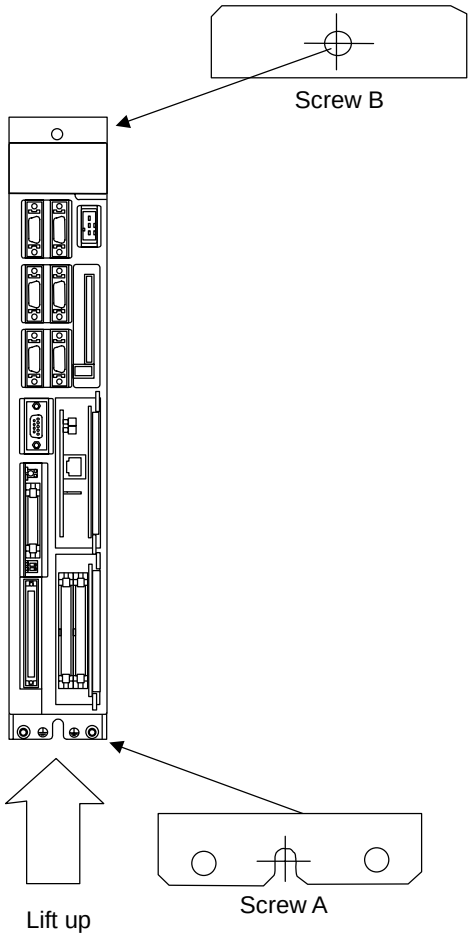
⚠ Do not replace the cooling fan while the power is ON.
⚠ Dispose of the spent fan according to local laws.

4.3.3 Control Unit

(1) Control unit

Always turn the machine power OFF before replacing the control unit.

(1) Disconnect all cables connected to the control unit.
(2) Remove all cards mounted in the control unit's extension slots.
(3) Loosen screw A. (There is no need to remove the screw.)
(4) While supporting the control unit with a hand, remove screw B.
(5) Lift up and remove the control unit.
(6) Replace with a new control unit, and fix the control unit with the fixing screws.
(7) Mount the cards into the extension slots.
(8) Correctly connect all cables that were connected.
(Connect the cables to the designated connectors.)



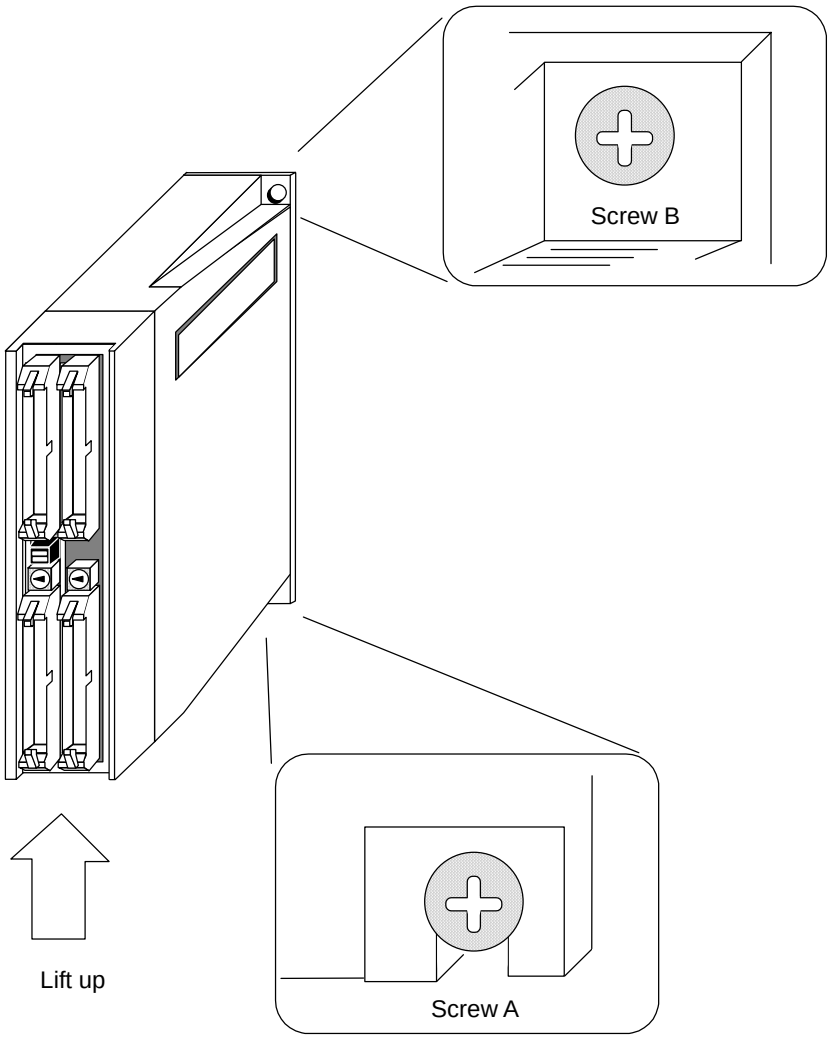
⚠ CAUTION

- **⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **⚠ Do not replace the control unit while the power is ON.**
- **⃠ Do not connect or disconnect the cables connected between each unit while the power is ON.**

(2) Remote I/O unit

Always turn the machine power OFF before replacing the remote I/O control unit.

(1) Disconnect all cables connected to the remote I/O unit.
(2) Loosen screw A. (There is no need to remove the screw.)
(3) While supporting the unit with the left hand, remove screw B.
(4) Lift up and remove the remote I/O unit.
(5) Replace with a new remote I/O unit, and fix the remote I/O unit with the fixing screws.
(6) Correctly connect all cables that were connected.
(Connect the cables to the designated connectors.)



⚠ CAUTION

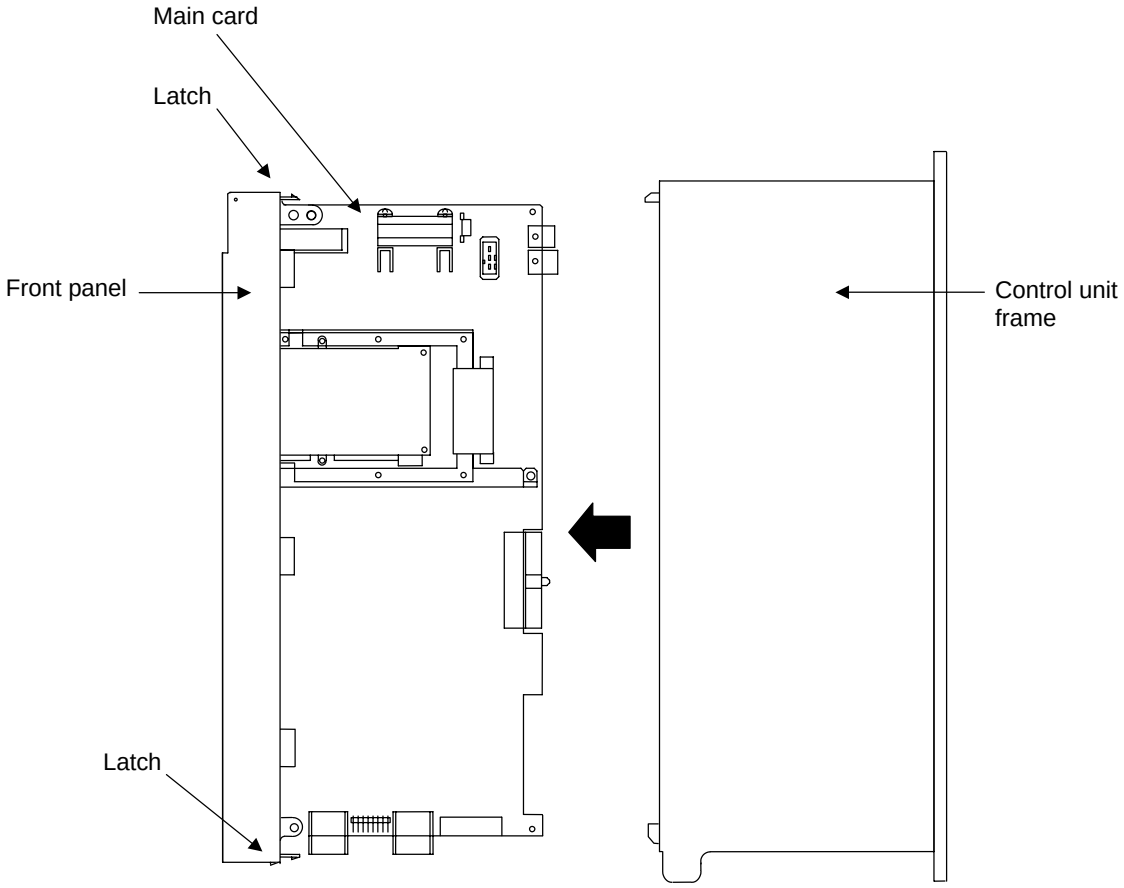
- **Incorrect connections could cause device damage, so always connect the cables to the designated connectors.**
- **Do not replace the control unit while the power is ON.**
- **Do not connect or disconnect the cables connected between each unit while the power is ON.**

4.3.4 Control PCB

(1) Main card

Always turn the control unit power OFF before replacing the main card.

(1) Confirm that the control unit power is OFF. (If the power is not OFF, turn it OFF.)
(2) Disconnect all cables connected to the control unit's connectors.
(3) Remove all cards mounted in the control unit's extension slots.
(4) Press the latches at the top and bottom of the control unit's front panel, and pull the front panel with the main card.
Hold the front panel section with a hand, and take care not to touch the PCB.
Take care hereafter, as if the main card is contacted against metal sections, the data backed up in the memory will be damaged.
(5) Replace with the new card. Align the main card with the rails on the control unit frame, and press in until the latches lock.
(6) Mount the cards in the control unit's extension slots.
(7) Correctly connect all cables that were connected.



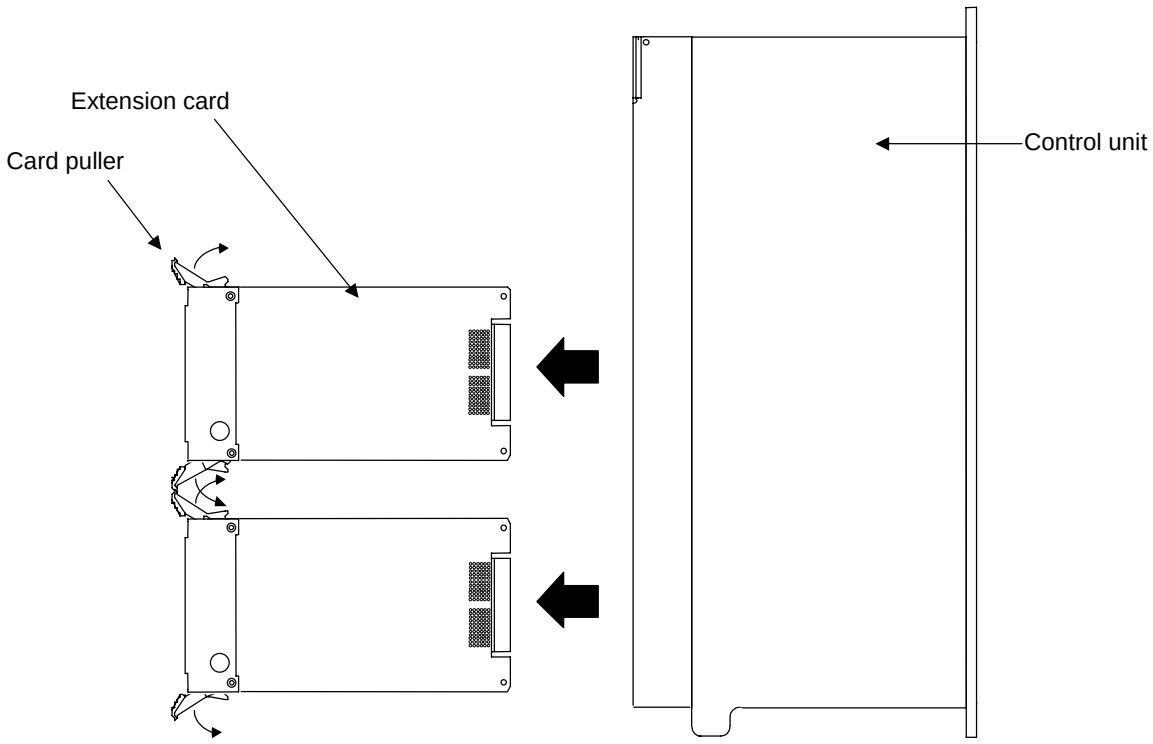
⚠ CAUTION

⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.
⚠ Do not replace the control section power PCB while the power is ON.
⊘ Do not connect or disconnect the cables connected between each unit while the power is ON.

(2) Extension card

Always turn the control unit power OFF before replacing the extension card.

(1) Confirm that the control unit power is OFF. (If the power is not OFF, turn it OFF.)
(2) Disconnect all cables connected to the extension card's connectors.
(3) Open the card puller on the extension card outward, and pull the card out.
Hold the card puller section, and take care not to touch the PCB.
(4) Replace with a new card. Align the card with the extension slot rails, and press into the back.
(5) Correctly connect all cables that were connected.



⚠ CAUTION

⚠ Incorrect connections could cause device damage, so always connect the cables to the designated connectors.
⚠ Do not replace the extension PCB while the power is ON.
⃠ Do not connect or disconnect the cables connected between each unit while the power is ON.

Revision History

Date of revision	Manual No.	Revision details
Nov. 1999	BNP-B2255A	Correction of mistakes; Addition of Appendix 9 EMC Installation Guidelines
Nov. 2000	BNP-B2255B	• Details related to generation of smoke added to "Safety Precautions". • Caution regarding installation of ferrite core added to "I-5.13 Connecting the Display Unit with Ethernet". • Details related to SA output to "II-3.2 Troubleshooting". • Other mistakes corrected.
Nov. 2001	BNP-B2255C	• Drawings changed and cautions added to "I-3.4 Installation". • Explanations related to "I-5.14 Connecting the Network with MELSECNET/10", "I-5.15 Connecting the IO Device with CC-Link", and "I-5.16 Connecting the IO Device with DeviceNet" added. • Details listed in "I-Appendix 7 List of connector sets" reviewed. • "II-4.6 HR877/878 Card", "II-4.7 HR877/879 Card", "II-4.8 HR865 Card" and "II-4.9 HR871 Card" added. • Other mistakes corrected.
Dec. 2003	BNP-B2255D	• Rearranged orders of chapters. • Reviewed and revised details related to “I-3.1 General Specification”. • Reviewed and revised details related to “I-4.8 Connecting the Machine Control Signal”. • Reviewed and revised details related to “I-6.5 Outline of Digital Signal Input Circuit”. • Reviewed and revised details related to “I-Appendix 7.2 F311 Cable Manufacturing Drawing”. • Corrected other mistakes.
Mar. 2004	BNP-B2255E	• Added “Introduction”. • Added “Precautions for Safety”. • Reviewed and revised details related to “I-4.11 Connecting Other Peripheral Devices”. • Added “I-Appendix 1.2 Outline and Installation Dimensions for Control Unit with Extension Unit”. • Corrected other mistakes.

Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible.
Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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